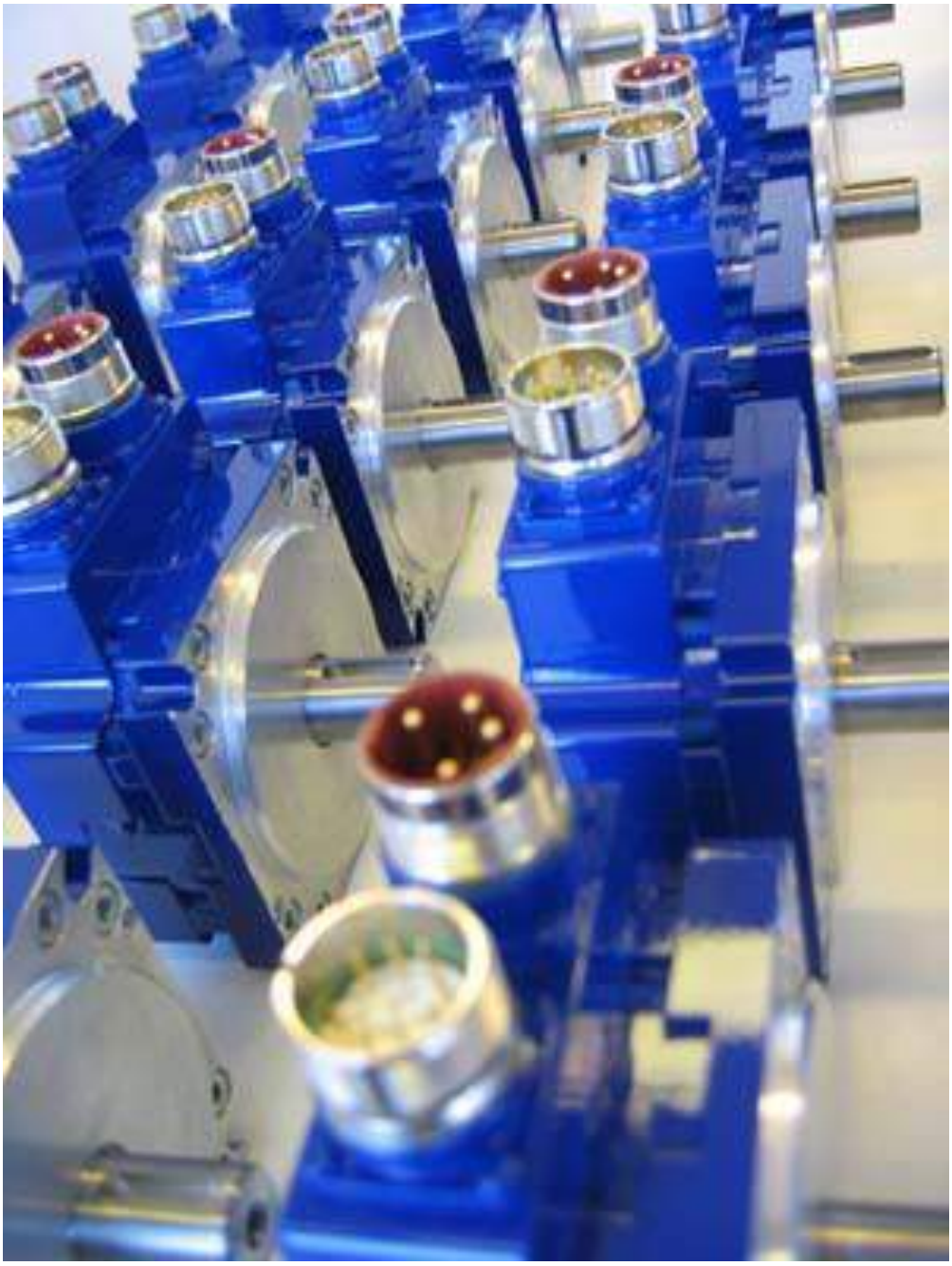
HDD Servo Motors AB

MANUAL



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Safety Advices

All operations on transport, assembly, start-up and maintenance must be done by skilled and qualified personnel only. The qualified personnel must know and observe the following standards and guidelines: DIN VDE 0105, IEC 364, accident prevention regulations. Deviant behaviour may cause serious injury to persons and may lead to damages.

Before mounting and start-up carefully read the documents on hand. Follow the instructions for power supply (motor label and manual) and go by the rules of the technical data.

Ensure a proper, low-impedance grounding of the motor housing with the PE-reference potential inside the switch cabinet, as otherwise personal safety is not assured.

Take suitable steps, that unexpected false move will not lead to injury or damage.

Power connection can also lead current, when motor is not rotating. Do not remove or pull off plugs during operation or power supply. This can lead to electric arcs which may hurt people or damage contacts.

Surface temperatures of more than 100°C can arise on the motors. Take care do not stick or fasten any temperature sensitive parts to it. Possibly make provisions for precautions against touch.

Installation / Start-up

Important notes

Check the assignment between inverter and motor. Compare rated voltage and rated current of the devices. The wiring has to be carried out in accordance to the circuit diagram shown in the installation/operation manual of the inverter.

Pay attention to proper grounding of inverter and motor.

Place power and signal cables separately from each other. When using motor power cables with integrated brake wires, the brake wires should be shielded. The shielding braid has to be applied both-sided.

Lay all circuits with sufficient cross section. Shields to be applied in great circle (low-resistance) via metalized connector housings resp. EMV - approved cable glands.

Assure sufficient heat removal in the surroundings and at the flange of the motor to not exceed the maximum permitted flange temperature of 650C in S1-operation. If necessary reduce the motor rating.

Caution!

Never remove the electric connections of the motor during power supply.
Residual charges inside the compacitor of the inverter can still exist up to 5 minutes after the disconnection of the main supply.
Power and signal connections can lead voltage even if the motor stands idle.

Before start-up respectively before mounting check the motors regarding damage in transit. Damages of any part of the motor as well as corrosion at the shaft or flange have to be reported immediately to us. The rotor should be easily rotating by hand. Existing brakes to be electrically let off in advance.

Environmental conditions

With regard to the installation site of the motor please take into consideration the environmental conditions like ambient temperature: -20...+40°C, maximum mounting height: 1000m above sea level, relative humidity: 15...85%, non-condensing.

A power reduction might possibly be necessary in case of tolerances to the a.m. environmental conditions. The motors are not suitable for outdoor installation or installation within aggressive or foreign substance afflicted atmosphere.

Drive elements

The rotor of the motor has been electronically counterbalanced during production. Before fitting your drive elements onto the shaft end, please remove the corrosion prevention (if existing).
Strictly use suitable tools for fitting or removing the drive elements and follow the advices of the drive element manufacturer to avoid damages.

Our recommendation: Use double conical tensioning devices.

Absolutely avoid strong pushes to the motor flange and the motor shaft during fitting or removing. This might lead to damages of the ball bearing or shaft

Power connections

The power connections have to be carried out by skilled electricians only. Before starting work make sure that the systems actually is and remains without current during the installation time.

Follow the safety rules according to DIN VDE 0105.

The cross-sectional area of the cable has to be layed out in accordance to the rated power of the motor. The environmental conditions, the way of laying and the local legal requirements have to be taken into consideration.

Strictly follow the advices of the inverter manufacturer to fulfil EMV-wiring conditions.

When using shielded cables take care of a great circle metallic shield connection on both sides of the cable.

Motor series

HDD Servo Motors AB offers four series of brushless, permanent-magnet servo motors, based on the same patented ultra-compact technology.

HDD – 20 pole shaft motors

HDD motors are equipped with a conventional shaft for easy assembly. They have 20 poles = 10 pole pairs.

ICM – 20 pole internal coupling motors

ICM motors are even more compact because the coupling is integrated within the motor. They have 20 poles = 10 pole pairs.

HSM – 20 pole hollow shaft motors

HSM motors allow cables, hoses, rotating shafts, etc. to pass through the servomotor's own shaft. They have 20 poles = 10 pole pairs.

HDD and ICM motors can be equipped with a range of different feedback systems (resolver, SICK/Stegmann Hiperface or Heidenhain Endat). These motors can optionally be equipped with a holding brake. The HSM motors are only available with Hiperface feedback and no brake.

HDT – 10 pole shaft motors

HDD motors are equipped with a conventional shaft for easy assembly. They have 10 poles = 5 pole pairs.

Insulation system

The insulation system complies with the requirements of EEC LV Directive 73/23/EEC and 93/68/EEC. Test report E9911111E01.

Overtemperature protection and thermistors

As a standard, HDD motors are equipped with overtemperature protection. The protection consists of three PTC thermistors in series, one for each phase. The PTC thermistors are manufactured according to norms DIN 44081 and DIN 44082. According to these norms, the resistance for a single thermistor at room temperature is in the range 20 Ohms - 250 Ohms. For three thermistors in series, the total room temperature resistance is typically between 150 Ohms - 300 Ohms (50 Ohms - 100 Ohms per thermistor), but can be as high as 750 Ohm without indicating malfunction.
The PTC thermistors have a switch temperature of 150 C. When T < 145 C, R < 550 Ohm for each thermistor (R < 1650 Ohms for the whole triplet), and when T > 155 C, R > 1330 Ohm for each thermistor (R < 4990 Ohms for the whole triplet). The resistance should be measured with a d.c. voltage no greater than 2.5V.
As an option, HDD motors can be equipped with a temperature measurement device of type KTY84-130.

Couplings for ICM motors

Three types of couplings are presently available, all using metal bellows. There are two bellow lengths that can accommodate run-outs of 0.2 and 0.3 mm respectively. Both lengths have a stiffness of approx. 9 kNm/rad.

The CBE models shown in the top row uses an expanding shaft.
The standard diameter of the expanding shaft is 16f7; other shafts are available on request. The CBC model shown in the center row uses a single screw to clamp around the machine shaft. It can be delivered to fit shafts from 5 to 20mm. The CBS model shown in the bottom row uses two clamping screws. It can be delivered to fit shafts from 6 to 28mm.

Holding brake

HDD, ICM and HDT motors (but not HSM motors) have the option of an installed brake. The permanent-magnet brake is operated by 24 VDC and blocks the rotor when being without voltage.

The brake is to be understood as a holding brake and it is not to be used for permanent slow downs during production. When the brake is detached the rotor can operate without residual torque, the functioning is free from backlash. The brakes can be operated directly by the inverter . In this case the reset of the brake winding is effected without additional external wiring.

If the brake is not directly operated by the inverter and additional wiring (for example varistor) has to be carried out. A personnel-safe application of the brake needs an additional contact within the brake circuit and then also a release device for the brake (for example varistor).

The brake has the following characteristics:

Holding torque	9	Nm
Inertia J	0.4	kgcm^2
Operating voltage	24	V DC
Power dissipation	12	W

Motor name structure

The different fields in a motor type name, e.g. HDD 09J– Pa– Az– Az– A– A– AAA, contain the following information:

Motor type

HDD 09J– Pa– Az– Az– A– A– AAA

HDD	20 pole shaft motor
ICM	20 pole internal coupling motor
HSM	20 pole hollow shaft motor
HDT	10 pole shaft motor

Flange size

HDD **09**J–Pa– Az– Az– A– A– AAA

Approximate flange size in cm:

09 series	92 mm
14 series	140 mm
20 series	200 mm

Stator length

HDD 09**J**– Pa– Az– Az– A– A– AAA

A single letter indicates the stator length; the later the letter's position in the alphabet, the longer the stator. Currently the following lengths are available:

For 09 series:	E (shortest), J, N, Q, S (longest).
For 14 series	J (shortest), N, R (longest).
For 20 series:	J (shortest), N (longest).

Other stator lengths may be available on request.

Winding

HDD 09J– **Pa**– Az– Az– A– A– AAA

Pa suitable for 3000 rpm at rail voltage 560V
Ma suitable for 3000 rpm at rail voltage 320V
Kb suitable for 3000 rpm at rail voltage 180V

More generally, the first, uppercase, letter (P, M, K) roughly indicates the voltage constant; the later the letter in the alphabeth, the higher is the counter EMF. The second, lowercase, letter is used to distinguish between different windings that give roughly the same voltage constants.

Feedback type

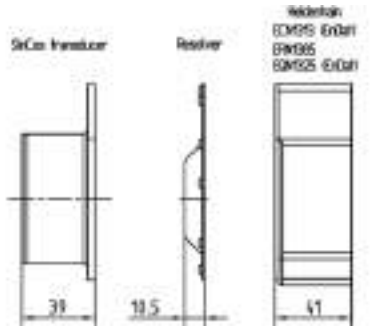
HDD 09– Pa– **Az**– Az– A– A– AAA

HDD motors are available with a large range of feedback options:

A	Resolver	7 V input, 1 pole pair, 0.5 transf. ratio	
D	Resolver	9 V input, 1 pole pair, 0.3 transf. ratio	
EA	Endat singleturn	32 periods (17 bit) per rev.	Electrically equivalent to ECI1317
EB	Endat multiturn	32 periods (17 bit) per rev.	Electrically equivalent to EQI1329
EC	Endat singleturn	32 periods (17 bit) per rev.	Electrically equivalent to ECI119
EF	Endat multiturn	25 bits per rev.	Electrically equivalent to EQN1337
EM	Endat multiturn	512 lines per rev.	Electrically equivalent to EQN1325
EN	Endat multiturn	2048 lines per rev.	Electrically equivalent to EQN1325
EO	Endat singleturn	2048 lines per rev.	Electrically equivalent to ERN1387

EP	Endat battery buffered multiturn	32 periods (17 bit) per rev.	Electrically equivalent to EBI1135
ES	Endat singleturn	512 lines per rev.	Electrically equivalent to ECN1313
ET	Endat singleturn	2048 lines per rev.	Electrically equivalent to ECN1313
SS	Hiperface singleturn	1024 lines per rev.	Electrically equivalent to SRS50
SM	Hiperface multiturn	1024 lines per rev.	Electrically equivalent to SRM50
SC	Hiperface singleturn 50mm hollow shaft	64 lines per rev.	Electrically equivalent to SEK90

The physical size of the motors depend on the choice of feedback, du to the size of the different transducers, cf the figure below:



Connector

HDD 09– Pa– Az– **A**z– A– A– AAA

This field specifies the connector type and location. The letters A, B, C, D, K and L are used for 4+3+PE power connectors, E, F, G, H, M and N are used for 5+PE power connectors, and P, Q, S, T, U, V for 5+3+PE. However, for legacy reasons motors with pinnings suitable for Parker and Siemens drives use the first series of letters, despite their six-pole connectors.

For a detailed specification of the mounting and connector pin-outs, see the Connector pin-outs section at the end of this document.

Pin-out suffix

HDD 09– Pa– A**z**– A**z**– A– A– AAA

HDD motors are designed to work with a large range of electronic drive systems. The pinnings of the power and feedback connectors are adapted to fit the standard cables from different drive manufacturers. Mechanical and electrical adjustment of the feedback are also made differently depending on the target drive. Currently pin-outs suitable for use with the following manufactures are available.

a HDD standard with thermistor in power connector.
z HDD standard with thermistor in feedback connector.
t HDD standard with both trip and KTY thermistors in power connector (no brake possible).
b Infranor
c Control Techniques
e Elau
f Ferrocontrol
h AMK
k Kollmorgen-Seidel
n Baldor
p Parker

s Siemens
u Baumüller
y Y-Tec

Not all feedback types are presently available with all pin-out suffices.

Brake

HDD 09– Pa– Az– Az– **A**– A– AAA

A = no brake,
D = holding brake.

Shaft key/sealed

HDD 09– Pa– Az– Az– A– **A**– AAA

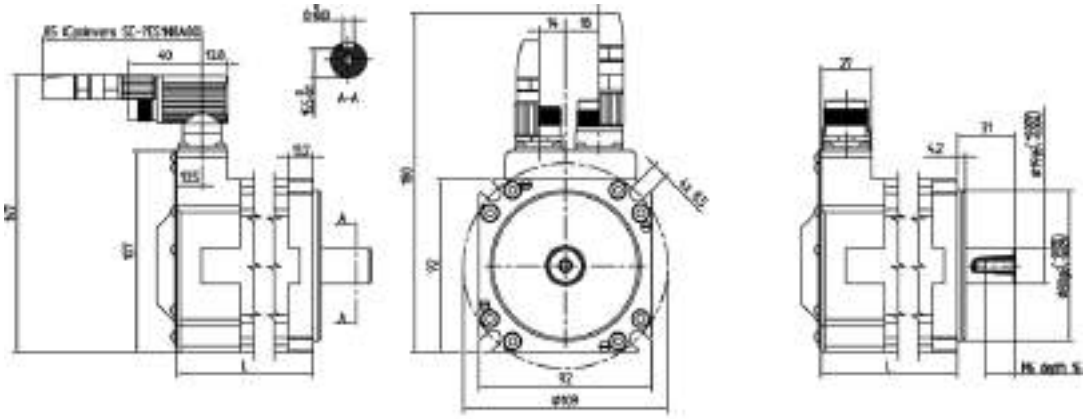
A = shaft with keyway (standard),
B = shaft without keyway.
C = sealed motor, shaft with keyway
D = sealed motor, shaft without keyway
X = special. Contact HDD for details.

Options

HDD 09– Pa– Az– Az– A– A– **AAA**

AAA = standard.
For other options please contact HDD.

HDD 09E



Mechanical data

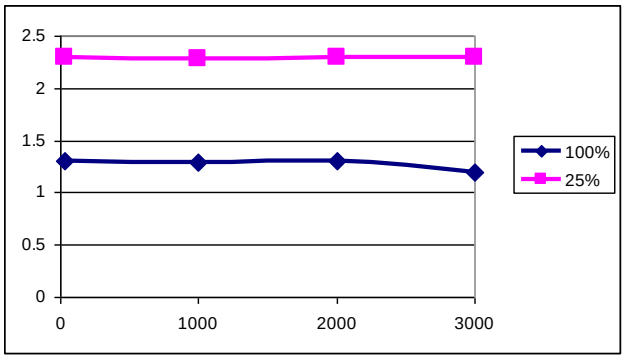
	Unit	without brake	with brake
Rotor inertia	kgcm^2	1.3	1.7
Mass (resolver version)	kg	1.8	2.4
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	47.3	72.7
Length with resolver	mm	57.8	83.2
Length with Hiperface transducer	mm	86.3	111.7
Length with Endat transducer	mm	88.3	113.7

Electrical data

	Unit	09E – Pa	09E – Ma	09E – Fa	
Number of poles		20	20	20	
Number of pole pairs		10	10	10	
Inductance/phase	mH	19	3.4	0.094	
Resistance/phase	Ohm	15	2.5	0.075	
Resistance/phase–phase	Ohm	30	5.0	0.13	
Back EMF/phase–phase RMS	Vs/rad	0.71	0.30	0.043	
Back EMF @ 1000 rpm	V	74	31	4.55	
Torque constant (RMS)	Nm/A	1.22	0.52	0.074	
Max rail voltage	V	750	750	750	
Recommended max current	A	3	7	49.5	
Torque at rec. max current	Nm	3.1	3.1	3.1	
Continuous torque at 30 rpm	Nm	1.3	1.3	1.3	
Continuous current at 30 rpm	A	1.2	2.8	19.8	
Continuous torque at 3000 rpm	Nm	1.2	1.2	1.2	
Continuous current at 3000 rpm	A	1.1	2.7	18.2	

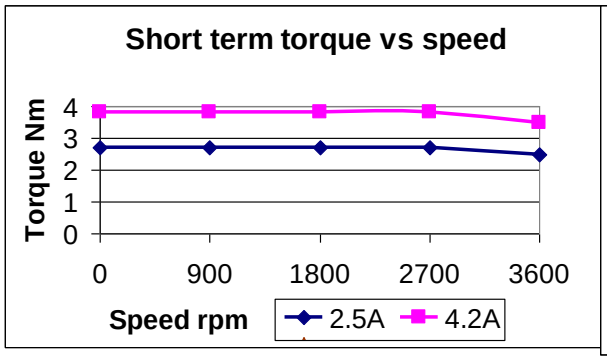
Torque versus speed

Data were measured on an HDD 09E–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



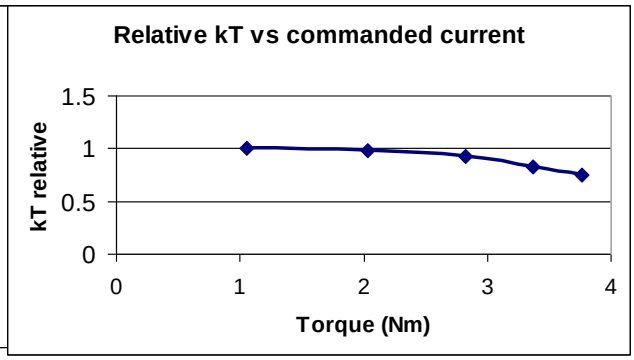
Short term torque

HDD 09E–Pa at 560V rail voltage



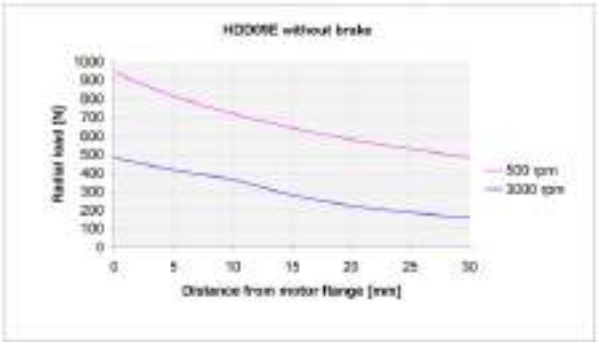
kT derating factor

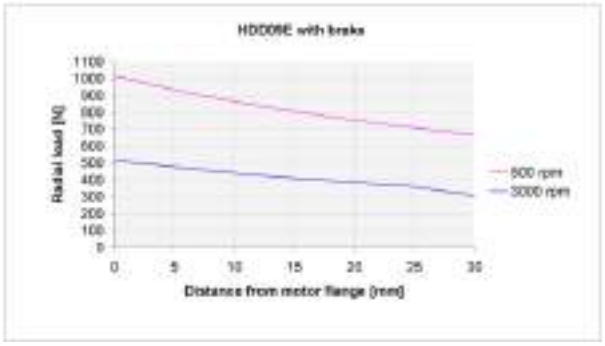
Low speed, HDD09E–Pa



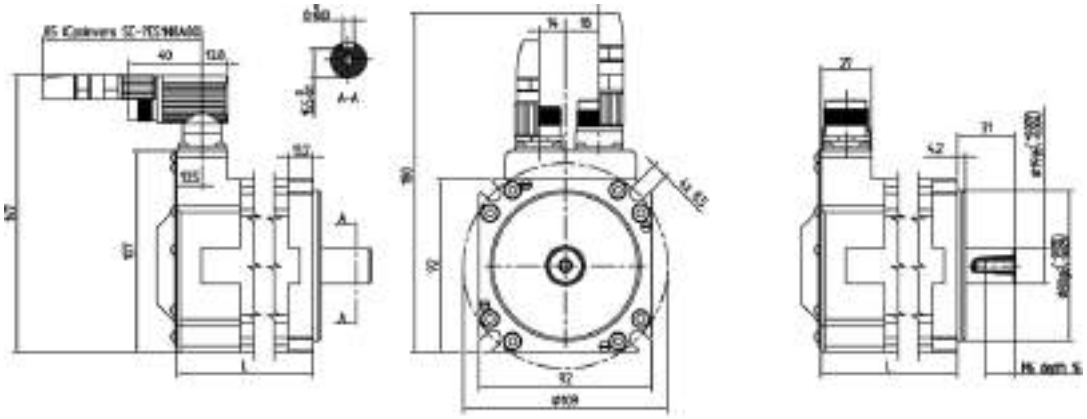
Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 350 N at 500 rpm, 100 N at 3000 rpm. Maximal axial load (pull): 50 N at all speeds. Maximal radial load at zero axial load is given by the curves below. For special cases please contact HDD for calculations.





HDD 09J



Mechanical data

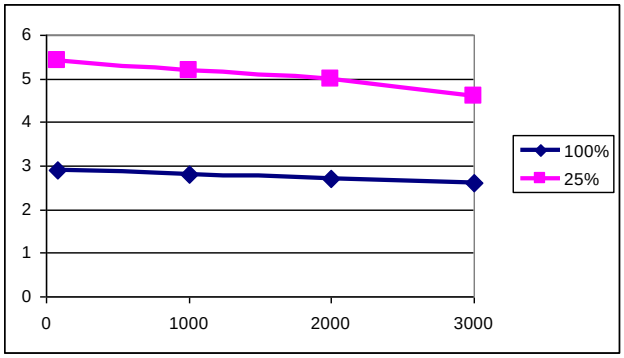
	Unit	without brake	with brake
Rotor inertia	kgcm^2	2.8	3.2
Mass (resolver version)	kg	2.4	3.0
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	59.6	85.1
Length with resolver	mm	70.1	95.6
Length with Hiperface transducer	mm	98.6	124.1
Length with Endat transducer	mm	100.6	126.1

Electrical data

	Unit	09J – Pa	09J –Ma	09J–Kb	
Number of poles		20	20	20	
Number of pole pairs		10	10	10	
Inductance/phase	mH	7.6	2.2	0.62	
Resistance/phase	Ohm	3.7	1.16	0.29	
Resistance/phase–phase	Ohm	7.4	2.32	0.58	
Back EMF/phase–phase RMS	Vs/rad	0.69	0.38	0.19	
Back EMF @ 1000 rpm	V	72	39	20	
Torque constant (RMS)	Nm/A	1.20	0.65	0.33	
Max rail voltage	V	750	750	750	
Recommended max current	A	7	14	24	
Torque at rec. max current	Nm	7.35	7.35	7.35	
Continuous torque at 100 rpm	Nm	2.8	2.8	2.8	
Continuous current at 100 rpm	A	2.5	4.3	8.6	
Continuous torque at 3000 rpm	Nm	2.3	2.3	2.3	
Continuous current at 3000 rpm	A	2.3	4.0	8.0	

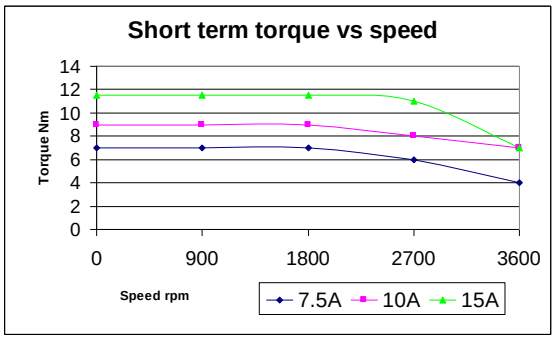
Torque vs speed

Data were measured on an HDD 09J–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



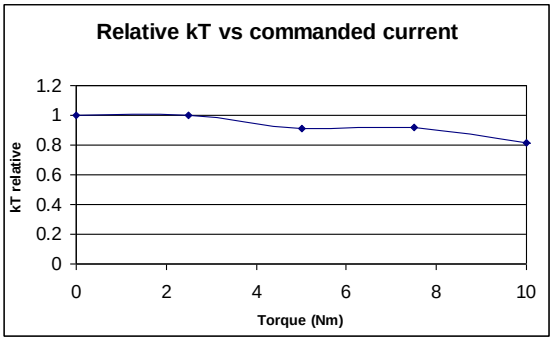
Short term torque

HDD 09J–Pa at 560V rail voltage



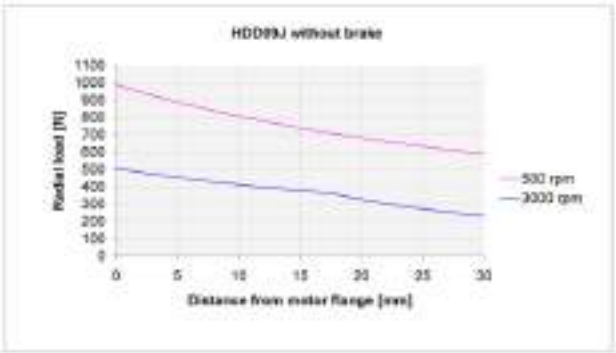
kT derating factor

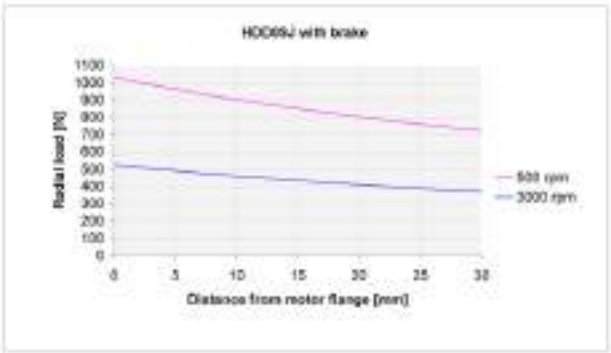
Low speed, HDD09J–Pa



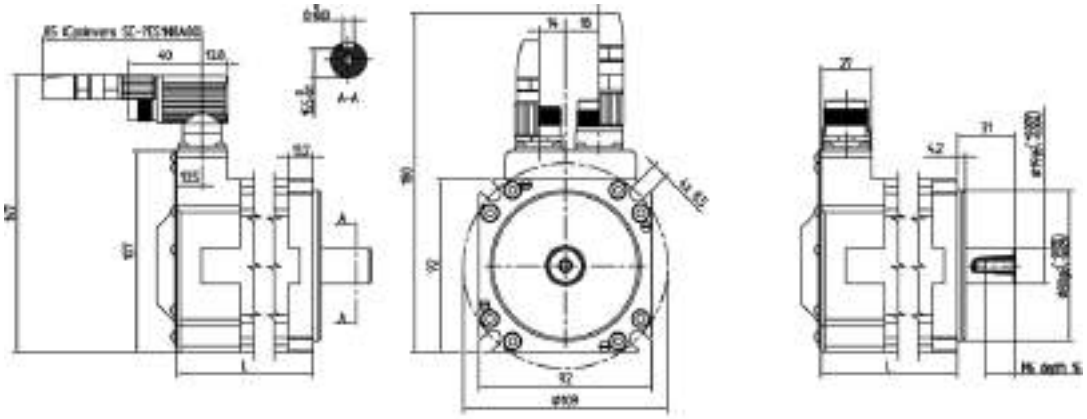
Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 350 N at 500 rpm, 100 N at 3000 rpm. Maximal axial load (pull): 50 N at all speeds. Maximal radial load at zero axial load is given by the curves below. For special cases please contact HDD for calculations.





HDD 09N



Mechanical data

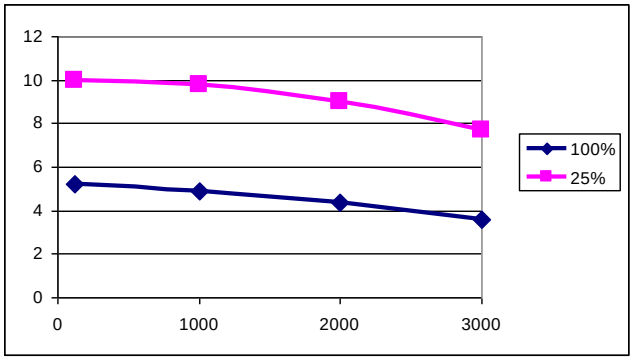
	Unit	without brake	with brake
Rotor inertia	kgcm^2	6.1	6.5
Mass (resolver version)	kg	3.6	4.2
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	87.3	112.7
Length with resolver	mm	97.8	123.2
Length with Hiperface transducer	mm	126.3	151.7
Length with Endat transducer	mm	128.3	153.7

Electrical data

	Unit	09N – Pa	09N –Ma		
Number of poles		20	20		
Number of pole pairs		10	10		
Inductance/phase	mH	4.9	1.23		
Resistance/phase	Ohm	1.9	0.47		
Resistance/phase–phase	Ohm	3.9	0.94		
Back EMF/phase–phase RMS	Vs/rad	0.84	0.42		
Back EMF @ 1000 rpm	V	88	44		
Torque constant (RMS)	Nm/A	1.46	0.73		
Max rail voltage	V	750	750		
Recommended max current	A	13	26		
Torque at rec. max current	Nm	16.4	16.4		
Continuous torque at 120 rpm	Nm	5.2	5.2		
Continuous current at 120 rpm	A	3.4	6.3		
Continuous torque at 3000 rpm	Nm	3.6	7.7		
Continuous current at 3000 rpm	A	3.3	6.3		

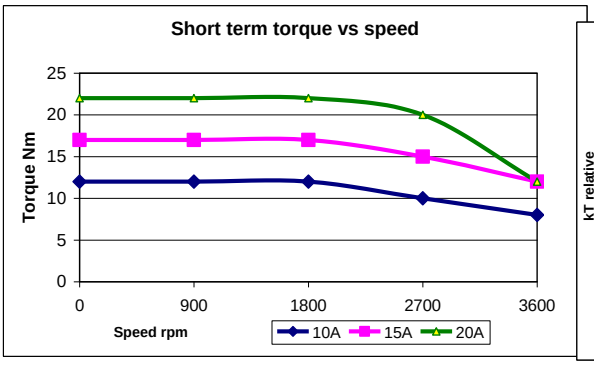
Torque vs speed

Data were measured on an HDD 09N–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



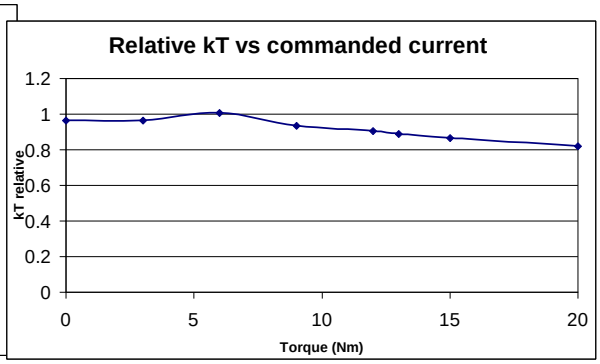
Short term torque

HDD 09N–Pa at 560V rail voltage



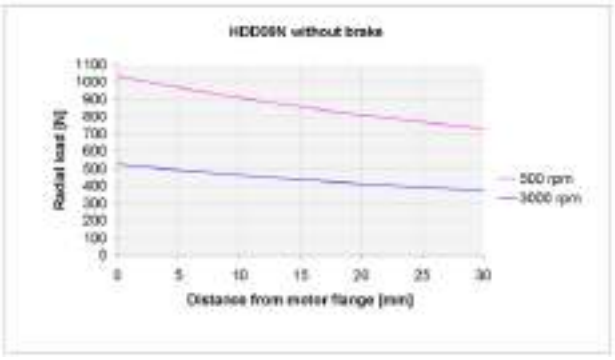
kT derating factor

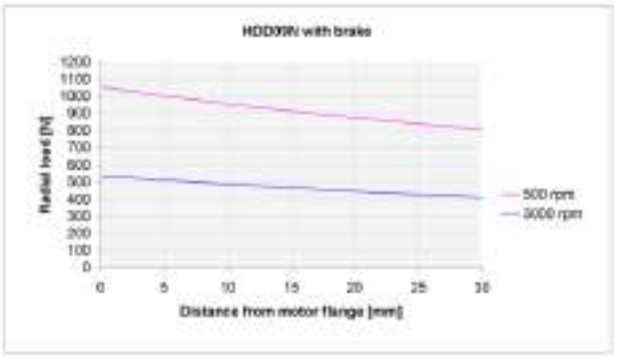
Low speed, HDD09N–Pa



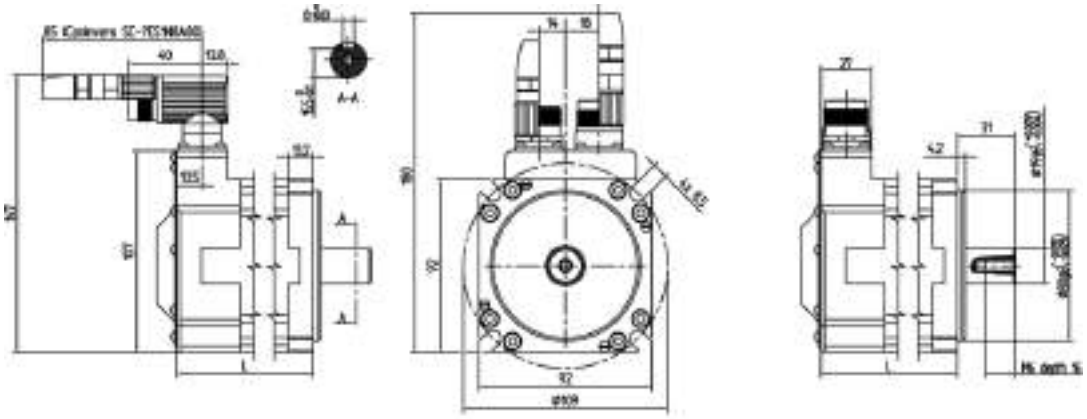
Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 350 N at 500 rpm, 100 N at 3000 rpm. Maximal axial load (pull): 50 N at all speeds. Maximal radial load at zero axial load is given by the curves below. For special cases please contact HDD for calculations.





HDD 09Q



Mechanical data

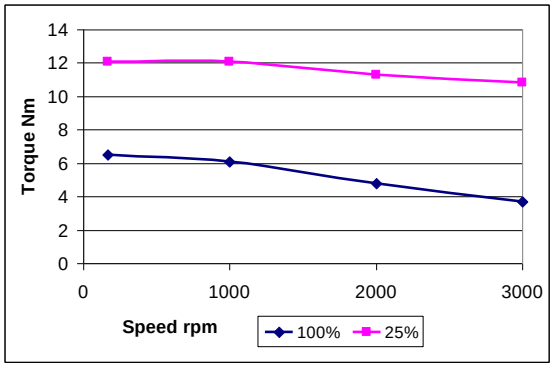
	Unit	without brake	with brake
Rotor inertia	kgcm^2	8.8	9.2
Mass (resolver version)	kg	4.7	5.3
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	109.7	137.3
Length with resolver	mm	120.2	147.8
Length with Hiperface transducer	mm	148.7	176.3
Length with Endat transducer	mm	150.7	178.3

Electrical data

	Unit	09Q – Pa			
Number of poles		20			
Number of pole pairs		10			
Inductance/phase	mH	2.7			
Resistance/phase	Ohm	1.0			
Resistance/phase–phase	Ohm	2.0			
Back EMF/phase–phase RMS	Vs/rad	0.76			
Back EMF @ 1000 rpm	V	80			
Torque constant (RMS)	Nm/A	1.32			
Max rail voltage	V	750			
Recommended max current	A	18			
Torque at rec. max current	Nm	18			
Continuous torque at 165 rpm	Nm	6.5			
Continuous current at 165 rpm	A	5.3			
Continuous torque at 3000 rpm	Nm	3.7			
Continuous current at 3000 rpm	A	3.0			

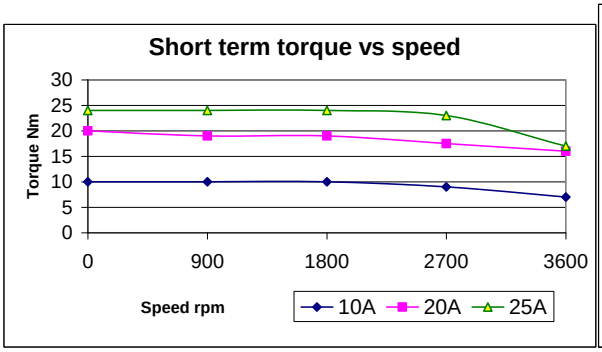
Torque vs speed

Data were measured on an HDD 09Q–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



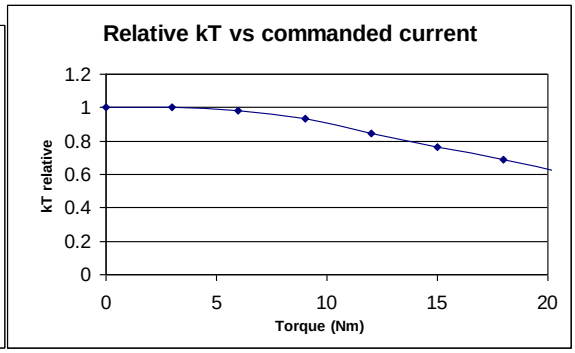
Short term torque

HDD 09Q–Pa at 560V rail voltage



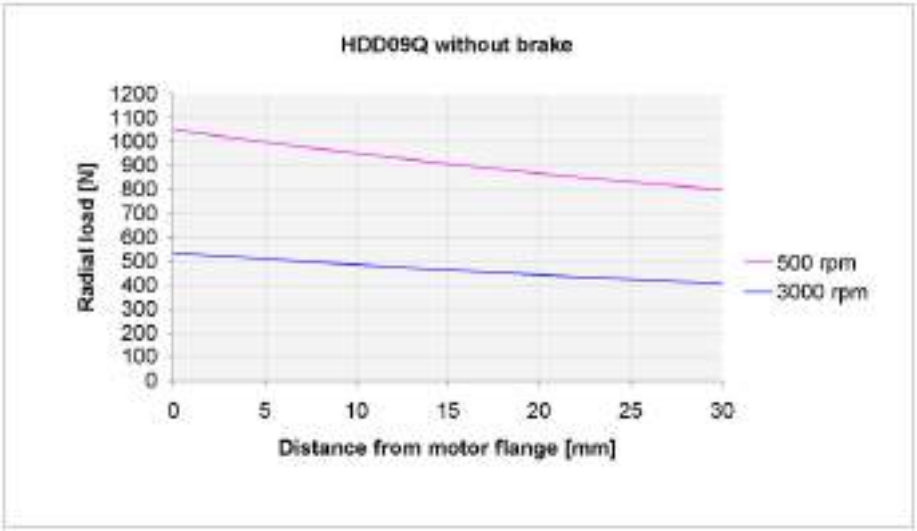
kT derating factor

Low speed, HDD 09Q–Pa

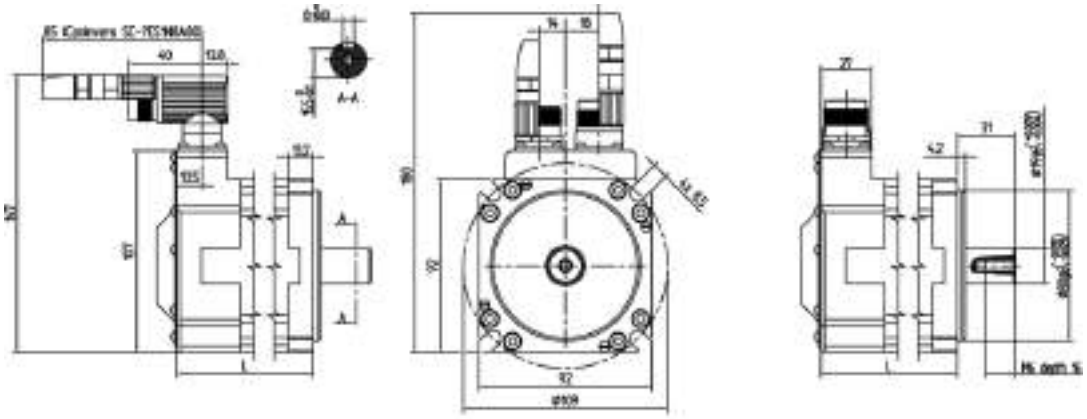


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 350 N at 500 rpm, 100 N at 3000 rpm. Maximal axial load (pull): 50 N at all speeds. Maximal radial load at zero axial load is given by the curves below. For special cases please contact HDD for calculations.



HDD 09S



Mechanical data

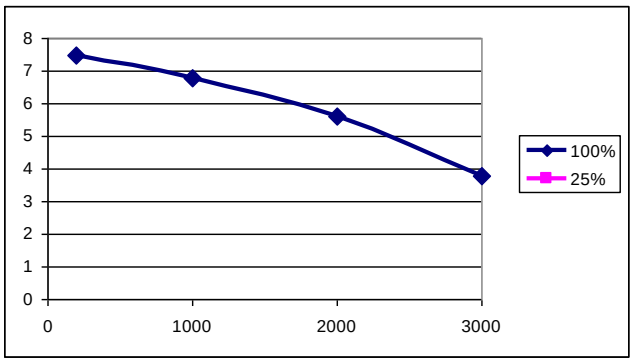
	Unit	without brake	with brake
Rotor inertia	kgcm^2	12.0	
Mass (resolver version)	kg	5.7	
Flange height	mm	92	
Flange width	mm	92	
Length “L”	mm	137.3	
Length with resolver	mm	147.8	
Length with Hiperface transducer	mm	176.3	
Length with Endat transducer	mm	178.3	

Electrical data

	Unit	09S – Pa			
Number of poles		20			
Number of pole pairs		10			
Inductance/phase	mH	2.45			
Resistance/phase	Ohm	1.0			
Resistance/phase–phase	Ohm	1.9			
Back EMF/phase–phase RMS	Vs/rad	0.76			
Back EMF @ 1000 rpm	V	80			
Torque constant (RMS)	Nm/A	1.46			
Max rail voltage	V	750			
Recommended max current	A	26			
Torque at rec. max current	Nm	33			
Continuous torque at 200 rpm	Nm	7.5			
Continuous current at 200 rpm	A	5.6			
Continuous torque at 3000 rpm	Nm	3.8			
Continuous current at 3000 rpm	A	3.2			

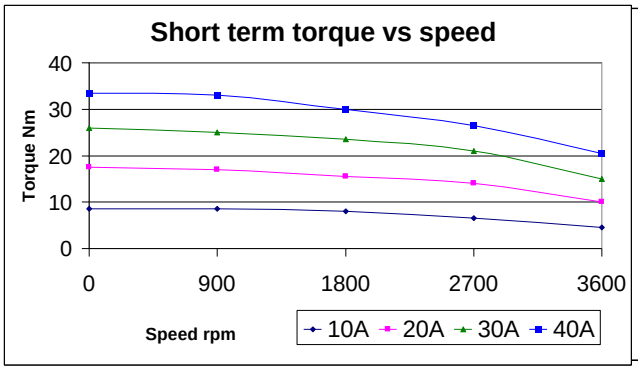
Torque vs speed

Data were measured on an HDD 09S–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Only continuous torque has been measured



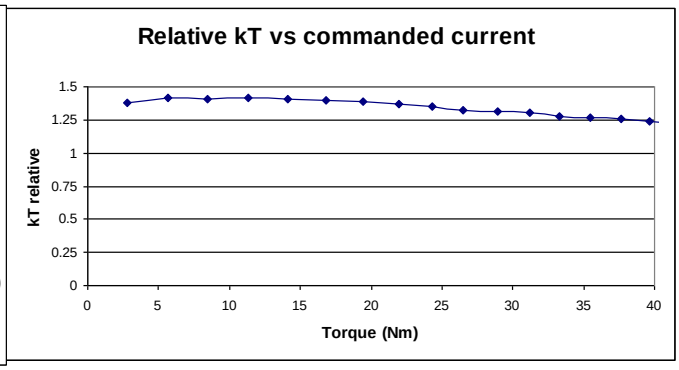
Short term torque

HDD 09S–Pa at 560V rail voltage



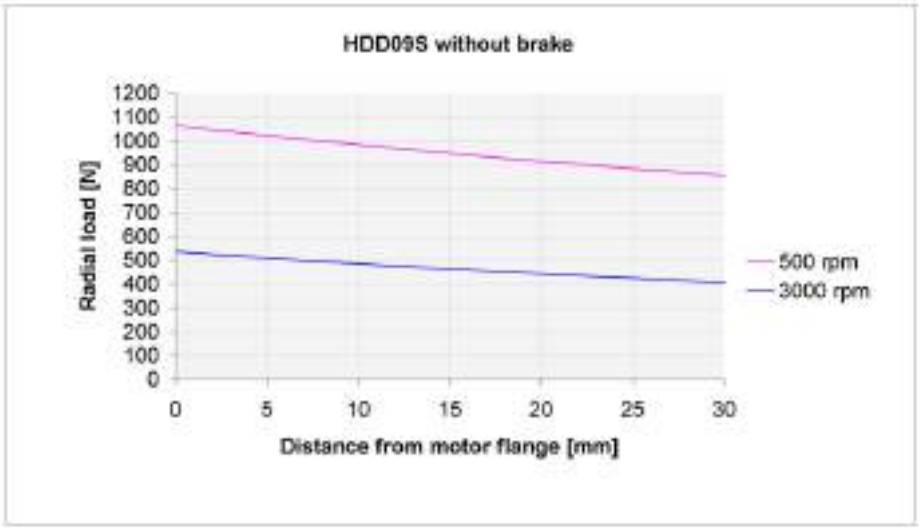
kT derating factor

Low speed, HDD 09S–Pa

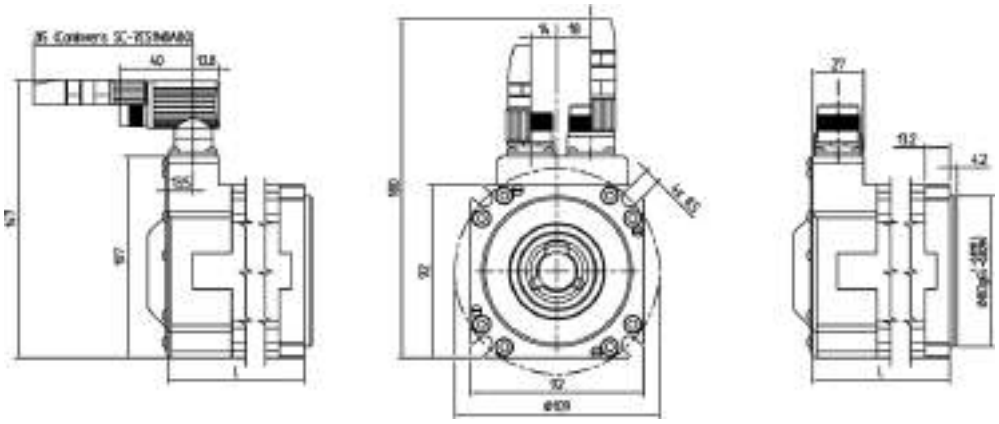


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 350 N at 500 rpm, 100 N at 3000 rpm. Maximal axial load (pull): 50 N at all speeds. Maximal radial load at zero axial load is given by the curves below. For special cases please contact HDD for calculations.



ICM 09J



Mechanical data

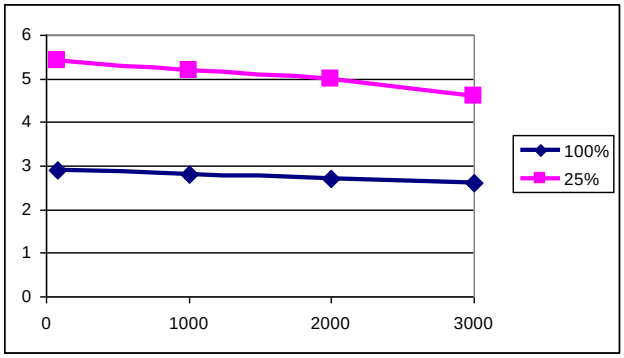
	Unit	without brake	with brake
Rotor inertia	kgcm^2	2.6	3.0
Mass (resolver version)	kg	2.1	2.7
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	59.6	85.1
Length with resolver	mm	70.1	95.6
Length with Hiperface transducer	mm	98.6	124.1
Length with Endat transducer	mm	100.6	126.1

Electrical data

	Unit	09J – Pa	09J –Ma	09J–Kb	
Number of poles		20	20	20	
Number of pole pairs		10	10	10	
Inductance/phase	mH	7.6	2.2	0.62	
Resistance/phase	Ohm	3.7	1.16	0.29	
Resistance/phase–phase	Ohm	7.4	2.32	0.58	
Back EMF/phase–phase RMS	Vs/rad	0.69	0.38	0.19	
Back EMF @ 1000 rpm	V	72	39	20	
Torque constant (RMS)	Nm/A	1.20	0.65	0.33	
Max rail voltage	V	750	750	750	
Recommended max current	A	7	14	24	
Torque at rec. max current	Nm	7.35	7.35	7.35	
Continuous torque at 80 rpm	Nm	2.9	2.9	2.9	
Continuous current at 80 rpm	A	2.5	4.3	8.6	
Continuous torque at 3000 rpm	Nm	2.6	2.6	2.6	
Continuous current at 3000 rpm	A	2.3	4.0	8.0	

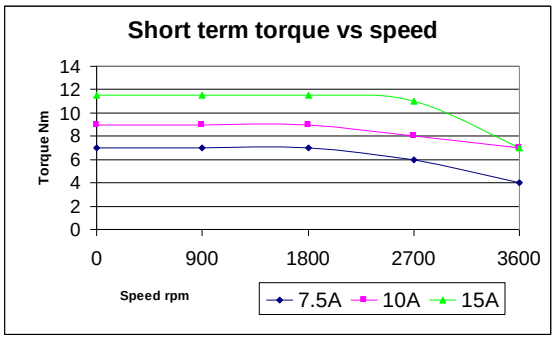
Torque vs speed

Data were measured on an ICM 09J–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



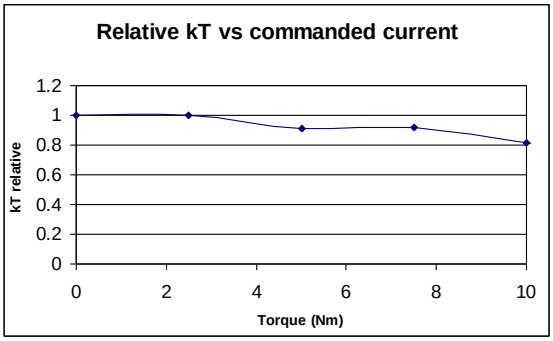
Short term torque

ICM 09J–Pa at 560V rail voltage

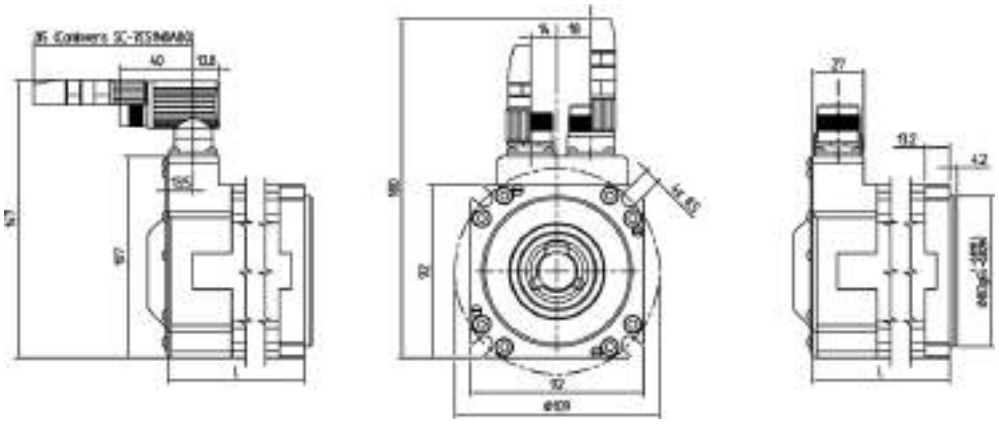


kT derating factor

Low speed, ICM 09J–Pa



ICM 09N



Mechanical data

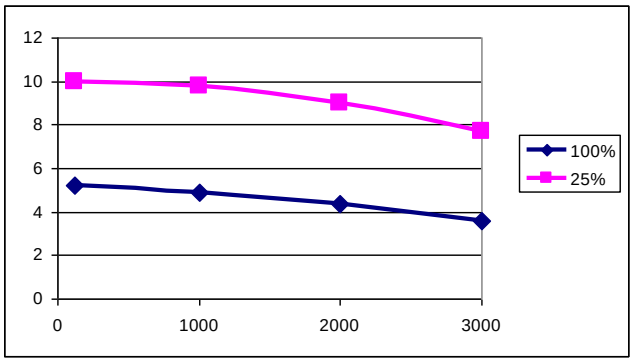
	Unit	without brake	with brake
Rotor inertia	kgcm^2	5.5	5.9
Mass (resolver version)	kg	3.0	3.6
Flange height	mm	92	92
Flange width	mm	92	92
Length “L”	mm	87.3	112.7
Length with resolver	mm	97.8	123.2
Length with Hiperface transducer	mm	126.3	151.7
Length with Endat transducer	mm	128.3	153.7

Electrical data

	Unit	09N – Pa	09N –Ma		
Number of poles		20	20		
Number of pole pairs		10	10		
Inductance/phase	mH	4.9	1.23		
Resistance/phase	Ohm	1.9	0.47		
Resistance/phase–phase	Ohm	3.9	0.94		
Back EMF/phase–phase RMS	Vs/rad	0.84	0.42		
Back EMF @ 1000 rpm	V	88	44		
Torque constant (RMS)	Nm/A	1.46	0.73		
Max rail voltage	V	750	750		
Recommended max current	A	13	26		
Torque at rec. max current	Nm	16.4	16.4		
Continuous torque at 120 rpm	Nm	5.2	5.2		
Continuous current at 120 rpm	A	3.4	6.3		
Continuous torque at 3000 rpm	Nm	3.6	7.7		
Continuous current at 3000 rpm	A	3.3	6.3		

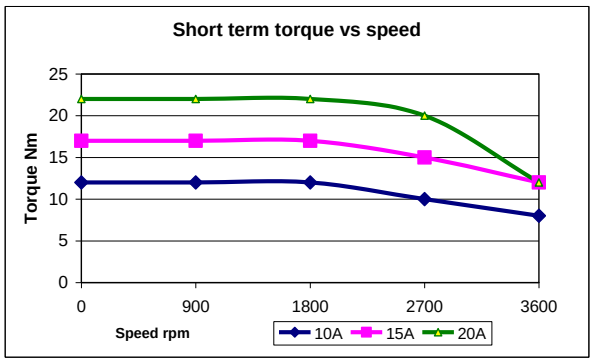
Torque vs speed

Data were measured on an ICM 09N–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



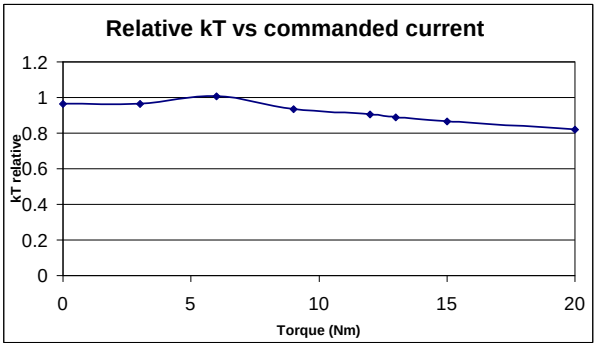
Short term torque

ICM 09N–Pa at 560V rail voltage

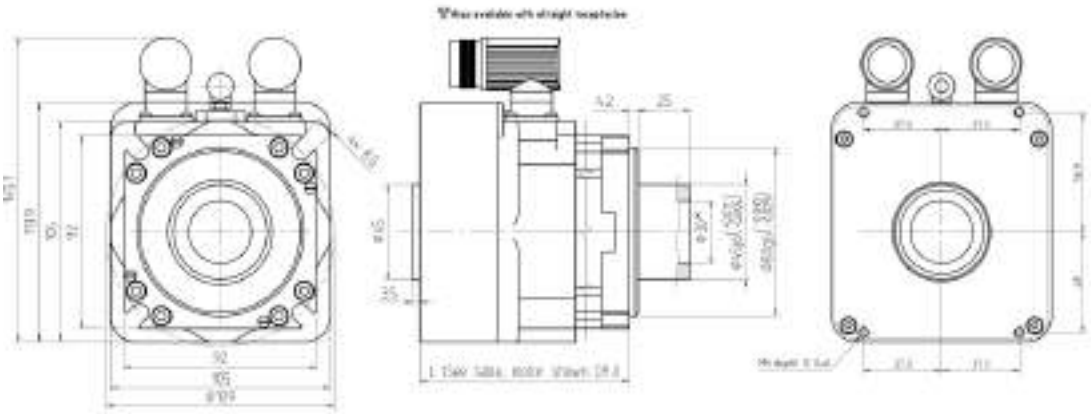


kT derating factor

Low speed, ICM 09N–Pa



HSM 09J



Mechanical data

	Unit	singleturn w/o brake	multiturn w/o brake
Rotor inertia	kgcm^2	5.1	5.5
Mass	kg	3.3	3.6
Flange height	mm	92	92
Flange width	mm	92	92
Length “L” with Hiperface transducer	mm	100.2	100.2

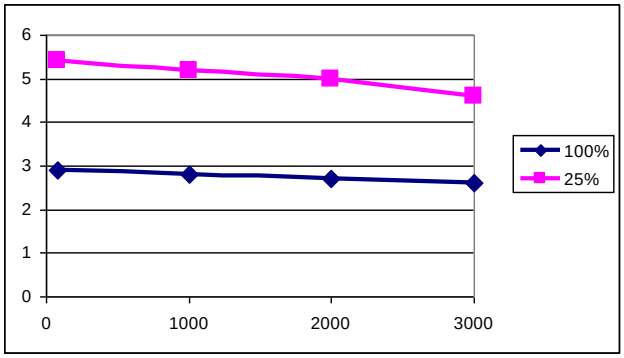
Electrical data

	Unit	09J – Pa	09J –Ma	09J–Kb	
Number of poles		20	20	20	
Number of pole pairs		10	10	10	
Inductance/phase	mH	7.6	2.2	0.62	
Resistance/phase	Ohm	3.7	1.16	0.29	
Resistance/phase–phase	Ohm	7.4	2.32	0.58	
Back EMF/phase–phase RMS	Vs/rad	0.67	0.34	0.19	
Back EMF @ 1000 rpm	V	71	36	20	
Torque constant (RMS)	Nm/A	1.17	0.60	0.32	
Max rail voltage	V	750	750	750	
Recommended max current	A	7	14	24	
Torque at rec. max current	Nm	7.35	7.35	7.35	
Continuous torque at 80 rpm	Nm	2.9	2.9	2.9	
Continuous current at 80 rpm	A	2.5	4.3	8.6	
Continuous torque at 3000 rpm	Nm	2.6	2.6	2.6	
Continuous current at 3000 rpm	A	2.3	4.0	8.0	

Note: Only available with Hiperface feedback and without brake.

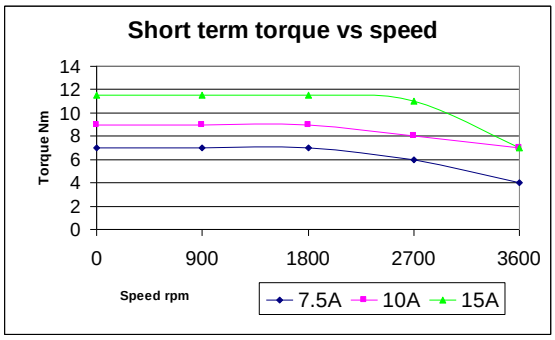
Torque vs speed

Data were measured on an HSM 09J–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



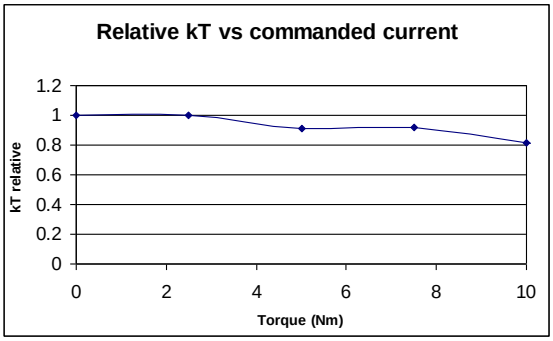
Short term torque

HSM 09J–Pa at 560V rail voltage



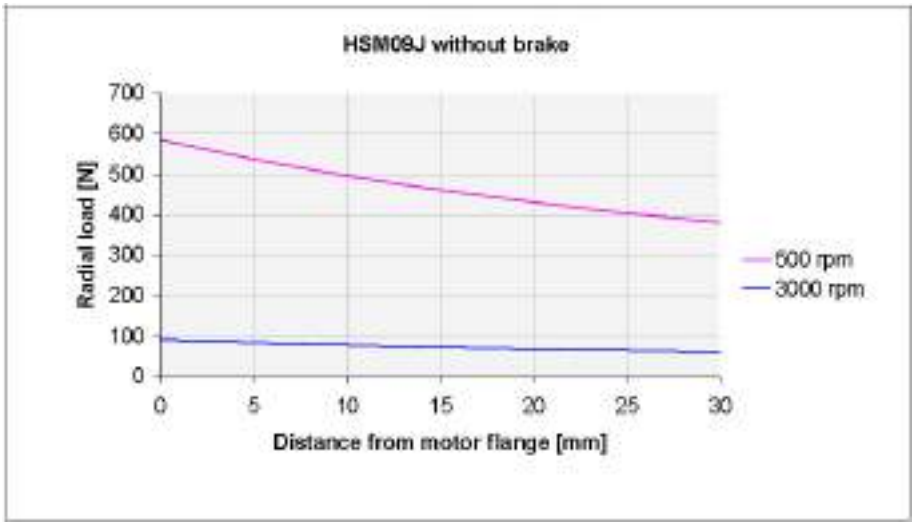
kT derating factor

Low speed, HSM09J–Pa

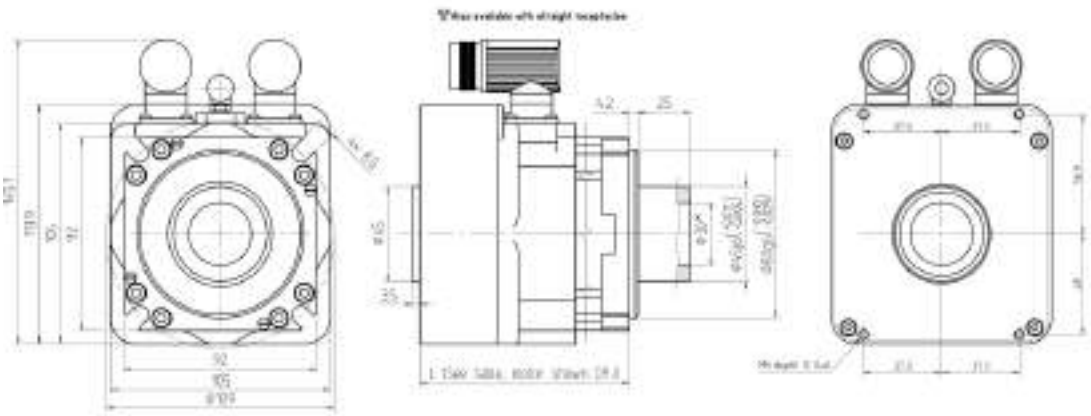


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 1600 N at 500 rpm, 650 N at 3000 rpm.
Maximal axial load (pull): 50 N at all speeds.
Maximal radial load is given by the curves below.



HSM 09N



Mechanical data

	Unit	singleturn w/o brake	multiturn w/o brake
Rotor inertia	kgcm^2	7.8	8.2
Mass	kg	3.8	4.1
Flange height	mm	92	92
Flange width	mm	92	92
Length “L” with Hiperface transducer	mm	127.9	127.9

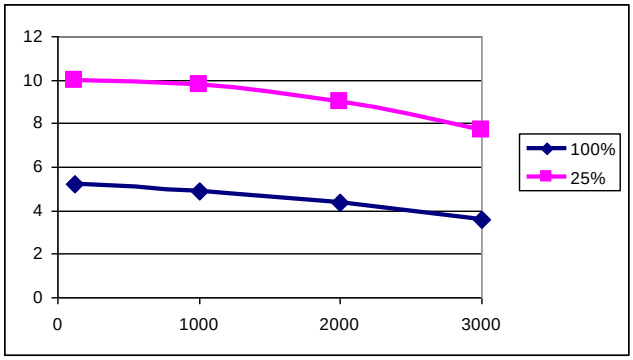
Electrical data

	Unit	09N – Pa	09N –Ma		
Number of poles		20	20		
Number of pole pairs		10	10		
Inductance/phase	mH	4.9	1.12		
Resistance/phase	Ohm	1.9	0.47		
Resistance/phase–phase	Ohm	3.9	0.94		
Back EMF/phase–phase RMS	Vs/rad	0.82	0.41		
Back EMF @ 1000 rpm	V	86	43		
Torque constant (RMS)	Nm/A	1.42	0.71		
Max rail voltage	V	750	750		
Recommended max current	A	13	26		
Torque at rec. max current	Nm	16.4	16.4		
Continuous torque at 120 rpm	Nm	5.2	5.2		
Continuous current at 120 rpm	A	3.4	6.3		
Continuous torque at 3000 rpm	Nm	3.6	7.7		
Continuous current at 3000 rpm	A	3.3	6.3		

Note: Only available with Hiperface feedback and without brake.

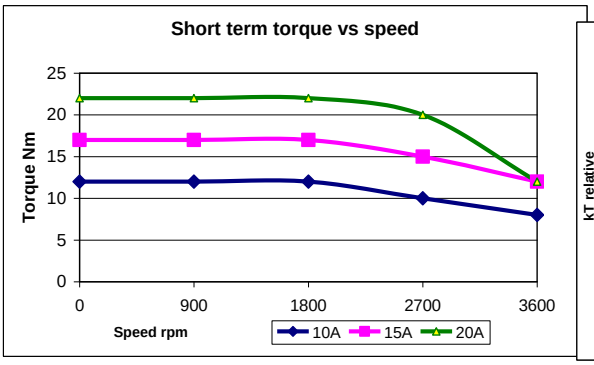
Torque vs speed

Data were measured on an HSM 09N–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



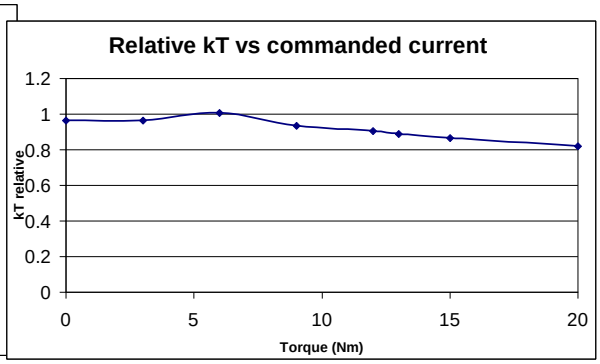
Short term torque

HSM 09N–Pa at 560V rail voltage



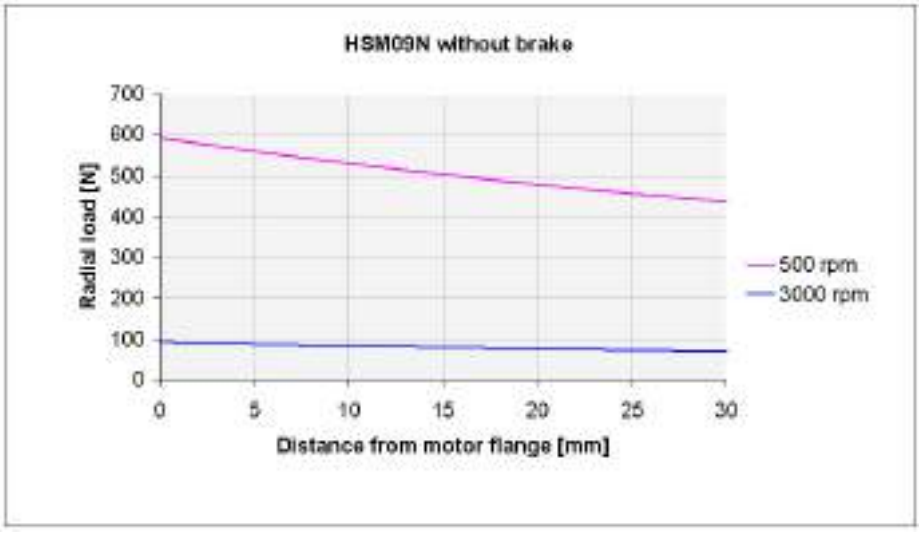
kT derating factor

Low speed, HSM 09N–Pa

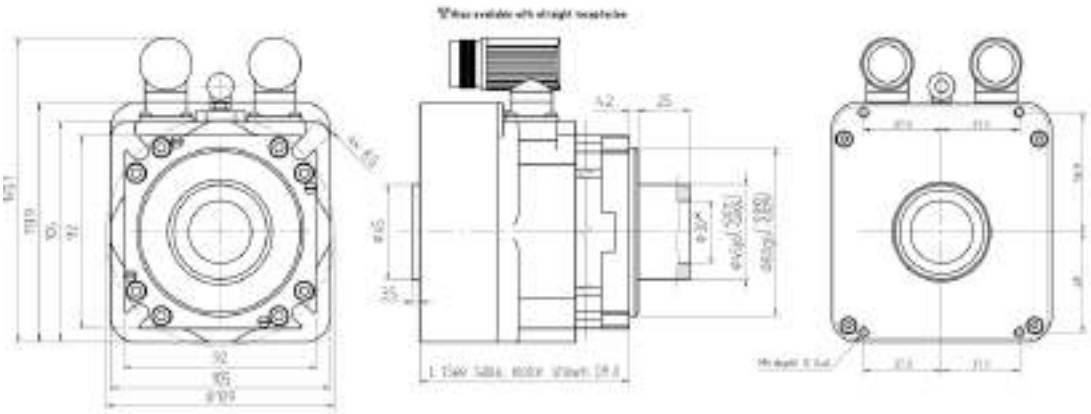


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 1600 N at 500 rpm, 650 N at 3000 rpm.
Maximal axial load (pull): 50 N at all speeds.
Maximal radial load is given by the curves below.



HSM 09Q



Mechanical data

	Unit	singleturn w/o brake	multiturn w/o brake
Rotor inertia	kgcm^2	10.0	10.5
Mass	kg	4.6	4.9
Flange height	mm	92	92
Flange width	mm	92	92
Length “L” with Hiperface transducer	mm	150.3	150.3

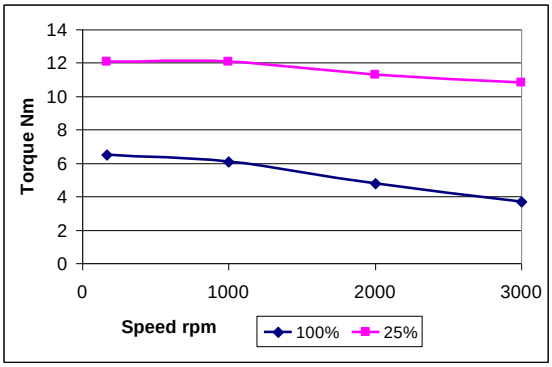
Electrical data

	Unit	09Q – Pa			
Number of poles		20			
Number of pole pairs		10			
Inductance/phase	mH	2.7			
Resistance/phase	Ohm	1.0			
Resistance/phase–phase	Ohm	2.0			
Back EMF/phase–phase RMS	Vs/rad	0.69			
Back EMF @ 1000 rpm	V	72			
Torque constant (RMS)	Nm/A	1.19			
Max rail voltage	V	750			
Recommended max current	A	18			
Torque at rec. max current	Nm	18			
Continuous torque at 30 rpm	Nm	6.5			
Continuous current at 30 rpm	A	5.3			
Continuous torque at 3000 rpm	Nm	3.7			
Continuous current at 3000 rpm	A	3.0			

Note: Only available with Hiperface feedback and without brake.

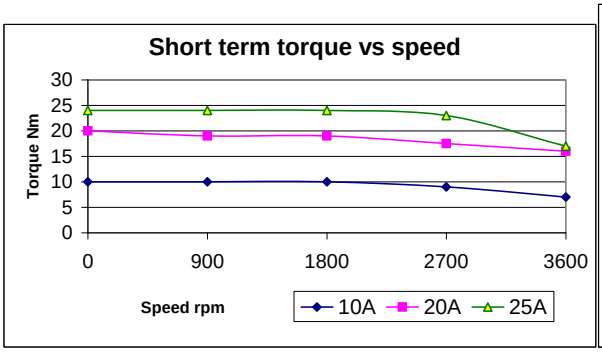
Torque vs speed

Data were measured on an HSM 09Q–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



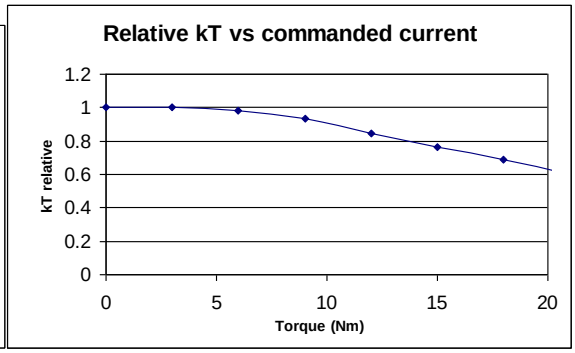
Short term torque

HSM 09Q–Pa at 560V rail voltage



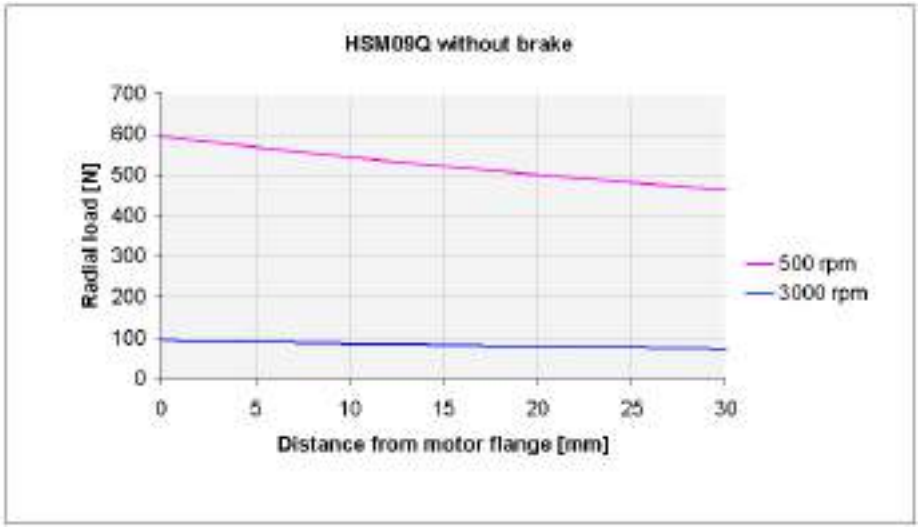
kT derating factor

Low speed, HSM 09Q–Pa

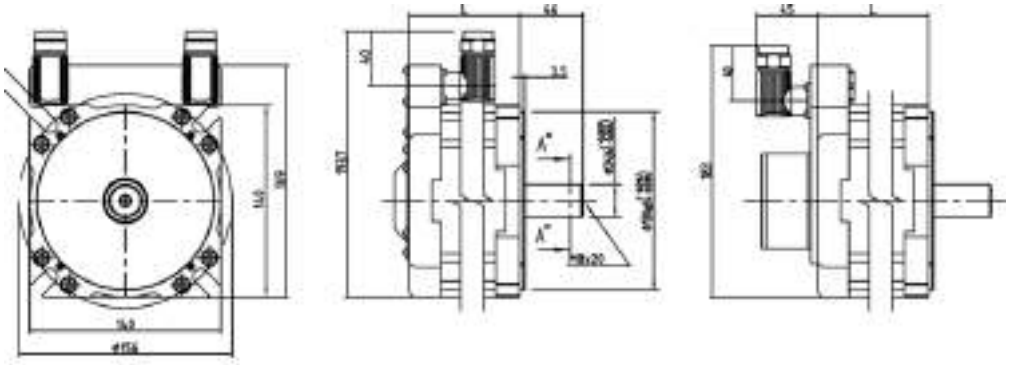


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 1600 N at 500 rpm, 650 N at 3000 rpm.
Maximal axial load (pull): 50 N at all speeds.
Maximal radial load is given by the curves below.



HDD 14J



Mechanical data

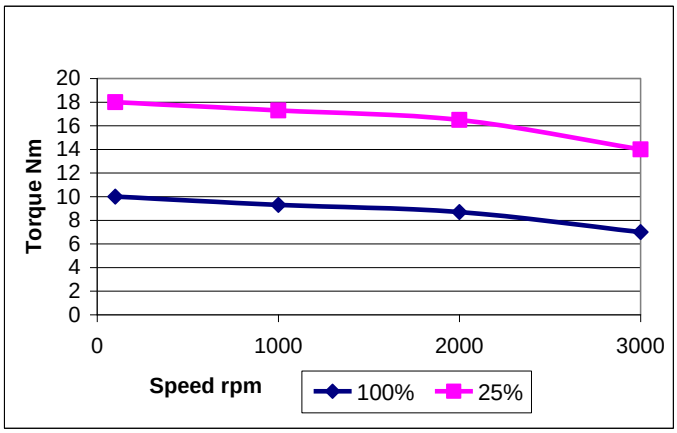
	Unit	without brake	with brake
Rotor inertia	kgcm^2	13.3	13.7
Mass (resolver version)	kg	6.0	6.5
Flange height	mm	140	140
Flange width	mm	140	140
Length “L”	mm	80.9	80.9
Length with resolver	mm	91.9	91.9
Length with Hiperface transducer	mm	121.9	121.9

Electrical data

	Unit	14J – Pa
Number of poles		20
Number of pole pairs		10
Inductance/phase	mH	4.4
Resistance/phase	Ohm	0.77
Resistance/phase–phase	Ohm	1.5
Back EMF/phase–phase RMS	Vs/rad	0.90
Back EMF @ 1000 rpm	V	94
Torque constant (RMS)	Nm/A	1.56
Max rail voltage	V	750
Recommended max current	A	30
Torque at rec. max current	Nm	40
Continuous torque at 120 rpm	Nm	10.0
Continuous current at 120 rpm	A	7.0
Continuous torque at 3000 rpm	Nm	7.0
Continuous current at 3000 rpm	A	5.3

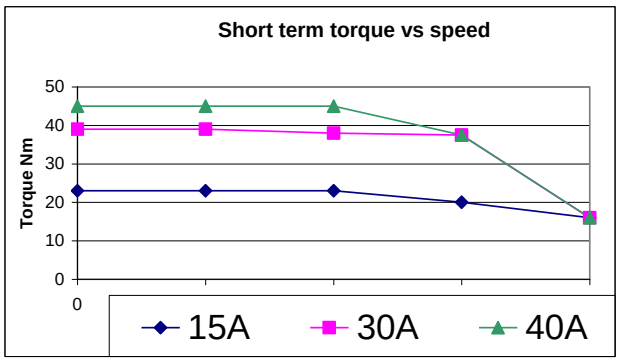
Torque vs speed

Data were measured on an HDD 14J–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



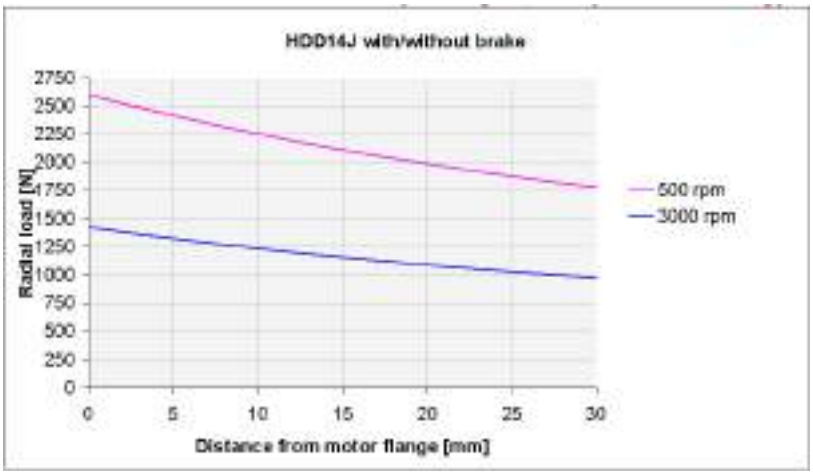
Short term torque

HDD 14J–Pa at 560V rail voltage

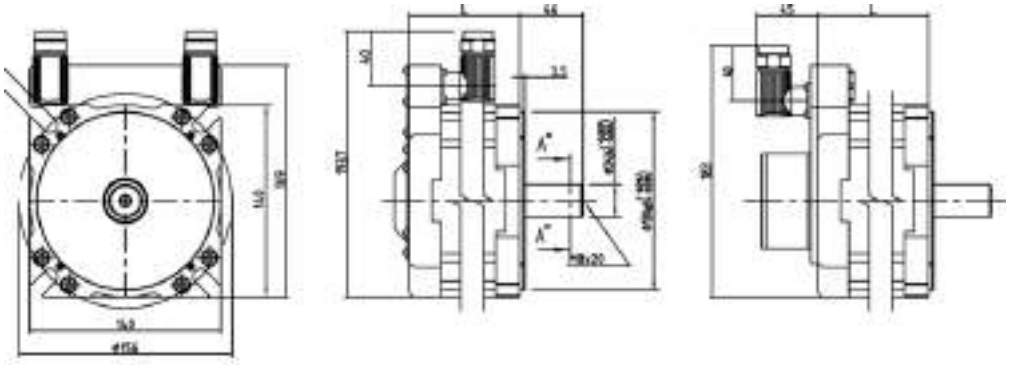


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 1000 N at 500 rpm, 300 at 3000 rpm. Maximal axial load (pull): 100 N at all speeds. Maximal radial load is given by the curves below. For special cases please contact HDD for calculations.



HDD 14N



Mechanical data

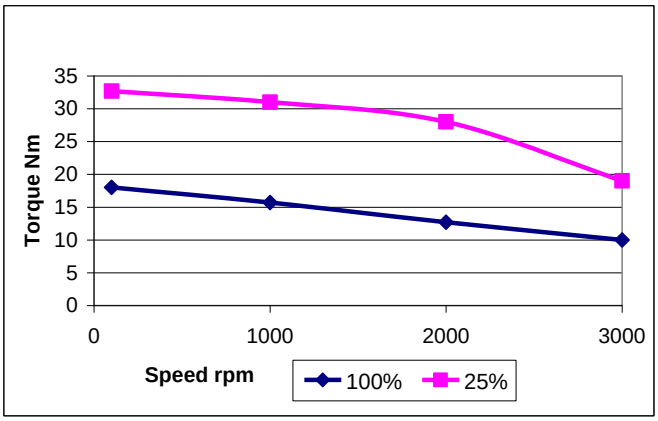
	Unit	without brake	with brake
Rotor inertia	kgcm^2	32.6	33.0
Mass (resolver version)	kg	10.0	10.5
Flange height	mm	140	140
Flange width	mm	140	140
Length “L”	mm	114.1	114.1
Length with resolver	mm	125.1	125.1
Length with Hiperface transducer	mm	155.1	155.1

Electrical data

	Unit	14N – Pa	14N – Ma
Number of poles		20	20
Number of pole pairs		10	10
Inductance/phase	mH	2.25	0.89
Resistance/phase	Ohm	0.32	0.14
Resistance/phase–phase	Ohm	0.64	0.29
Back EMF/phase–phase RMS	Vs/rad	0.90	0.55
Back EMF @ 1000 rpm	V	95	58
Torque constant (RMS)	Nm/A	1.57	0.96
Max rail voltage	V	750	750
Recommended max current	A	30	49
Torque at rec. max current	Nm	45	45
Continuous torque at 100 rpm	Nm	18.0	18.0
Continuous current at 100 rpm	A	12.5	20.5
Continuous torque at 3000 rpm	Nm	10.0	10.0
Continuous current at 3000 rpm	A	7.7	12.6

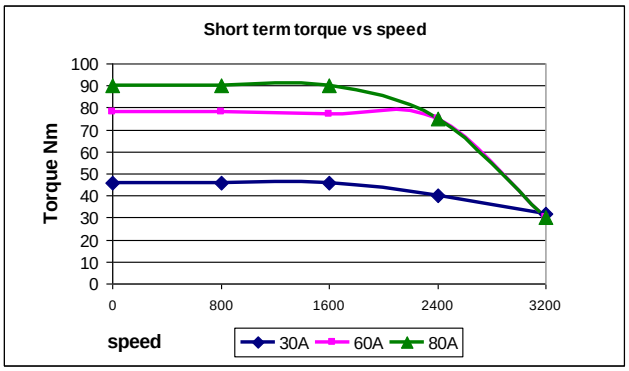
Torque vs speed

Data were measured on an HDD 14N–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



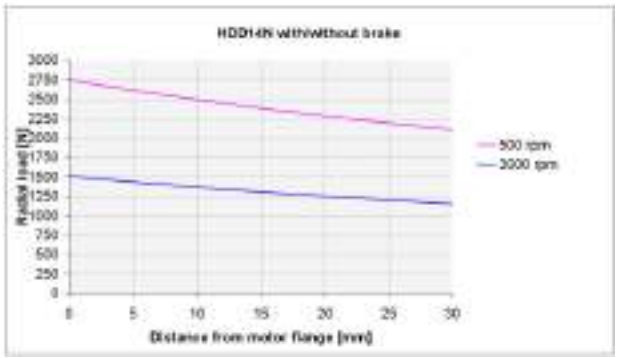
Short term torque

HDD 14N–Pa at 560V rail voltage

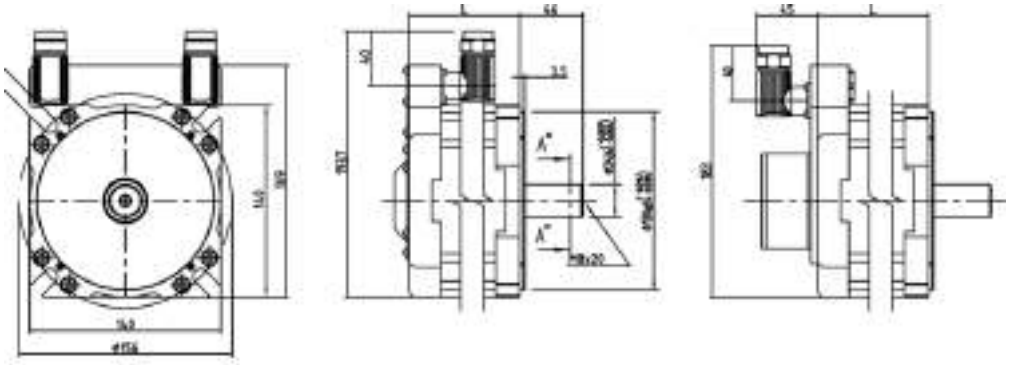


Maximum load on shaft at life expectancy 20,000 h

Maximal axial load (push): 1000 N at 500 rpm, 300 at 3000 rpm. Maximal axial load (pull): 100 N at all speeds. Maximal radial load is given by the curves below. For special cases please contact HDD for calculations.



ICM 14J



Mechanical data

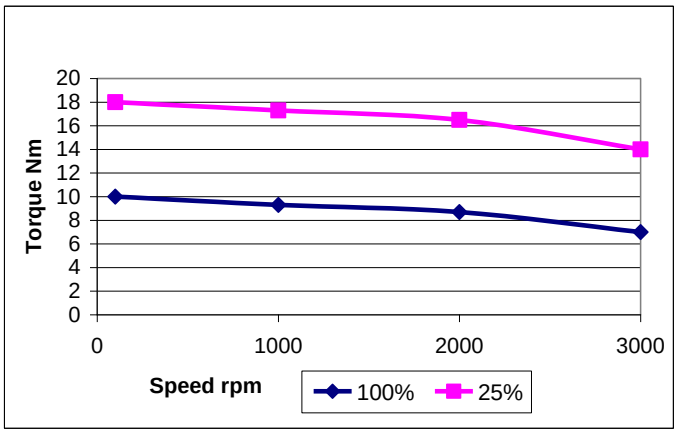
	Unit	without brake	with brake
Rotor inertia	kgcm^2	13.3	13.7
Mass (resolver version)	kg	6.0	6.5
Flange height	mm	140	140
Flange width	mm	140	140
Length “L”	mm	80.9	80.9
Length with resolver	mm	91.9	91.9
Length with Hiperface transducer	mm	121.9	121.9

Electrical data

	Unit	14J – Pa			
Number of poles		20			
Number of pole pairs		10			
Inductance/phase	mH	4.4			
Resistance/phase	Ohm	0.77			
Resistance/phase–phase	Ohm	1.5			
Back EMF/phase–phase RMS	Vs/rad	0.90			
Back EMF @ 1000 rpm	V	94			
Torque constant (RMS)	Nm/A	1.56			
Max rail voltage	V	750			
Recommended max current	A	30			
Torque at rec. max current	Nm	40			
Continuous torque at 120 rpm	Nm	10.0			
Continuous current at 120 rpm	A	7.0			
Continuous torque at 3000 rpm	Nm	7.0			
Continuous current at 3000 rpm	A	5.3			

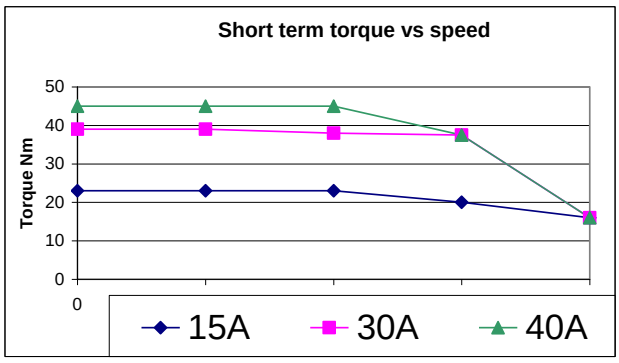
Torque vs speed

Data were measured on an ICM 14J–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):

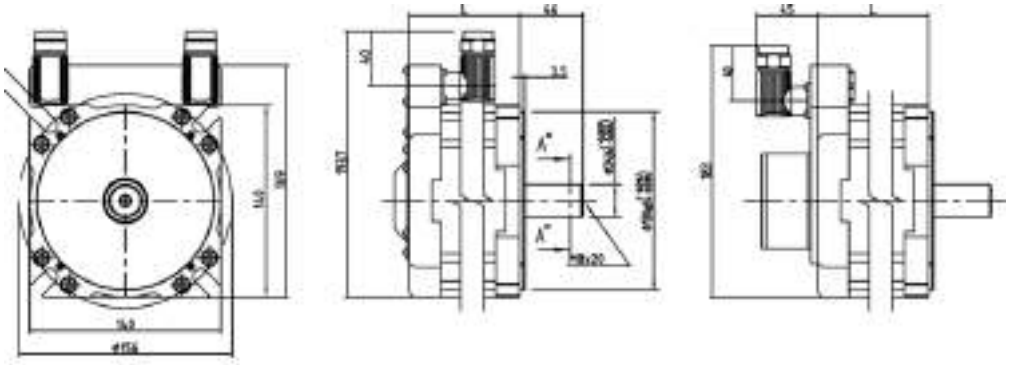


Short term torque

ICM 14J–Pa at 560V rail voltage



ICM 14N



Mechanical data

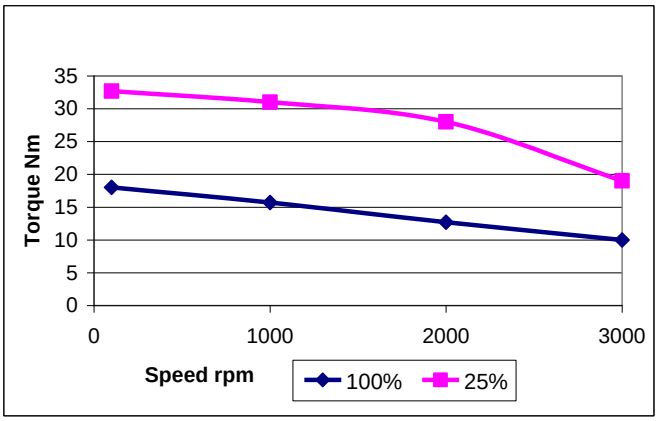
	Unit	without brake	with brake
Rotor inertia	kgcm^2	32.6	33.0
Mass (resolver version)	kg	10.0	10.5
Flange height	mm	140	140
Flange width	mm	140	140
Length “L”	mm	114.1	114.1
Length with resolver	mm	125.1	125.1
Length with Hiperface transducer	mm	155.1	155.1

Electrical data

	Unit	14N – Pa	14N – Ma		
Number of poles		20	20		
Number of pole pairs		10	10		
Inductance/phase	mH	2.25	0.89		
Resistance/phase	Ohm	0.32	0.14		
Resistance/phase–phase	Ohm	0.64	0.29		
Back EMF/phase–phase RMS	Vs/rad	0.90	0.55		
Back EMF @ 1000 rpm	V	95	58		
Torque constant (RMS)	Nm/A	1.57	0.96		
Max rail voltage	V	750	750		
Recommended max current	A	13	21		
Torque at rec. max current	Nm	16.4	16.4		
Continuous torque at 100 rpm	Nm	18.0	18.0		
Continuous current at 100 rpm	A	12.5	20.5		
Continuous torque at 3000 rpm	Nm	10.0	10.0		
Continuous current at 3000 rpm	A	7.7	12.6		

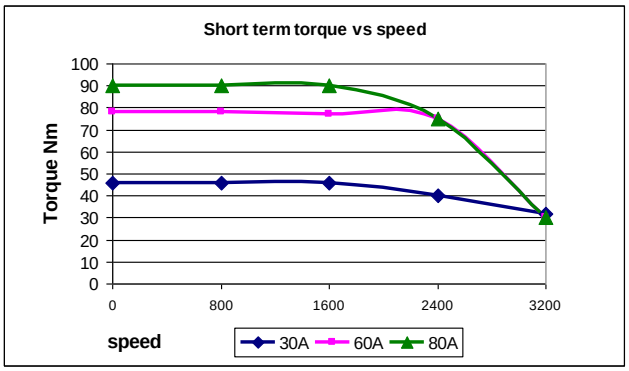
Torque vs speed

Data were measured on an ICM 14N–Pa series motor mounted on a vertical 260 x 200 x 12 mm aluminum plate in free air, with a winding temperature rise of 90ºC and driven by a commercially available inverter. Continuous torque and 25% duty cycle (1 minute on, 3 minutes off):



Short term torque

ICM 14N–Pa at 560V rail voltage



Connector pin-outs

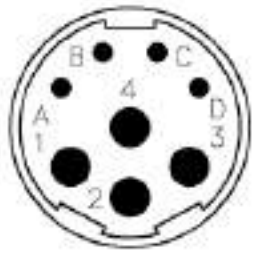
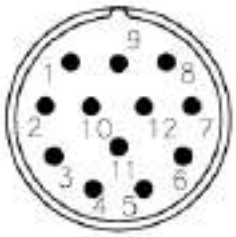
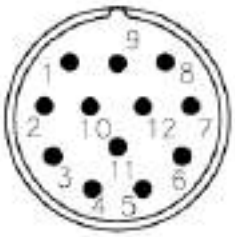
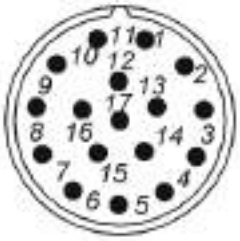
HDD does not manufacture power electronics itself. Instead, the motors can be equipped with different connectors with pinnings that fit standard cables of many major manufacturers of electronic drives. Currently connector pin-out suitable for power electronics from the following manufacturers are supported:

a	HDD default with thermistor in power connector
z	HDD default with thermistor in feedback connector
t	HDD default with trip thermistor and temperature measuring device
b	Infranor 1 (12-pole resolver connector)
b2	Infranor 2 (17-pole resolver connector)
c	Control-Techniques
e	Elau
f	Ferrocontrol
h	AMK
i	Bosch-Rexroth-Indramat 1 (8-pole power connector)
i2	Bosch-Rexroth-Indramat 2 (9-pole power connector)
k	Kollmorgen-Seidel
o	KEB
p	Parker
s	Siemens
u	Baumüller
y	Y-Tec

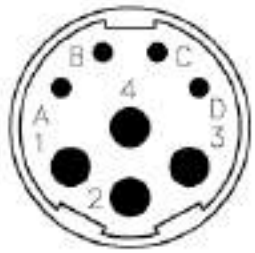
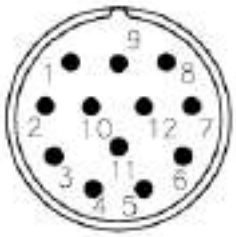
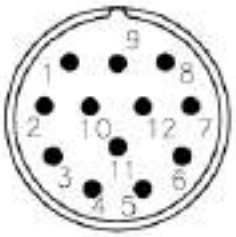
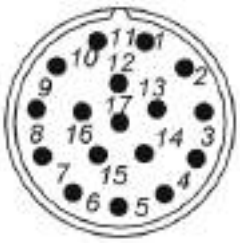
	Pin arrangement	**Mount**	**Sizes**
A	Intercontec 4+3+PE (or 5+PE)	straight top mount	09,14
B	Intercontec 4+3+PE (or 5+PE)	angled top mount	09,14
C	Intercontec 4+3+PE (or 5+PE)	straight rear mount	14
D	Intercontec 4+3+PE (or 5+PE)	angled rear mount	14
E	Intercontec 5+PE	straight top mount	09,14
F	Intercontec 5+PE	angled top mount	09,14
G	Intercontec 5+PE	straight rear mount	14
H	Intercontec 5+PE	angled rear mount	14
K	Intercontec 4+3+PE (or 5+PE)	straight forward mount	14
L	Intercontec 4+3+PE (or 5+PE)	angled forward mount	14
M	Intercontec 5+PE	straight forward mount	14
N	Intercontec 5+PE	angled forward mount	14
P	Intercontec 3+5+PE	straight top mount	09,14
Q	Intercontec 3+5+PE	angled top mount	09,14
S	Intercontec 3+5+PE	straight rear mount	14
T	Intercontec 3+5+PE	angled rear mount	14
U	Intercontec 3+5+PE	straight rear mount	14
V	Intercontec 3+5+PE	angled rear mount	14
X	Special connectors available on request. Contact HDD for details.		
Y	Speed Tech 12 pole	angled top mount	

The letters A, B, C, D, K and L are used for 4+3+PE power connectors, E, F, G, H, M and N are used for 5+PE power connectors, and P, Q, S, T, U, V for 5+3+PE. However, for legacy reasons motors with pinnings suitable for Parker and Siemens drives use the first series of letters, despite their six-pole connectors.

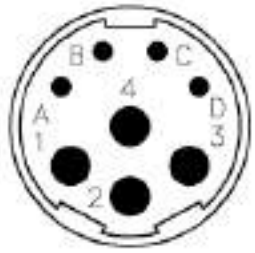
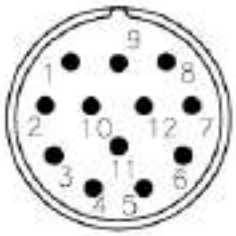
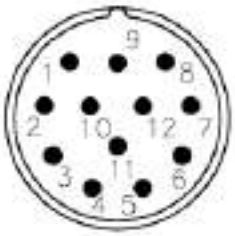
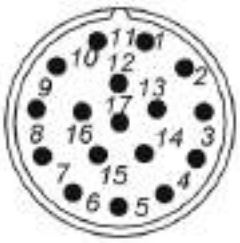
HDD Standard pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-A-**A**-A-A-AAA		HDD09J-Pa-**A**-A-A-A-AAA					
							
A	Straight top	A	2 poles, 0.5 transf. ratio	SS	Single turn	EM	EQN 1325, 512 lines/rev
B	Angled top	D	2 poles, 0.3 transf. ratio	SM	Multi turn	EN	EQN 1325, 2048 lines/rev
C	Straight rear			SC	Hollow shaft single turn	EQ	ECI 1118
D	Angled rear					ES	ECN 1313, 512 lines/rev
K	Straight front					ET	ECN 1313, 2048 lines/rev
L	Angled front					Without incremental signals:	
X	Special					ED	EBI 135
						EE	ECN 1325
						EF	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Exc hi R1	1	–	1	Sensor (U_P)
2	Ground	2	Exc lo R2	2	–	2	–
3	Phase W	3	–	3	Gnd	3	–
4	Phase V	4	Cos hi S1	4	Cos	4	Sensor (0V)
A	Brake +24V	5	Cos lo S3	5	RefCos	5	–
B	Brake 0V	6	Sin lo S4	6	RefSin	6	–
C	Trip thermistor	7	Sin hi S2	7	Sin	7	U_P
D	Trip thermistor	8	–	8	+VCC	8	Clock
		9	–	9	+RS485	9	Clock’
		10	–	10	–RS485	10	0V (U_N)
		11	–	11	–	11	Shield
		12	–	12	–	12	B+ (if incr)
						13	B– (if incr)
						14	Data
						15	A+ (if incr)
						16	A– (if incr)
						17	Data’

z: HDD Standard pin–out with thermistor in feedback connector

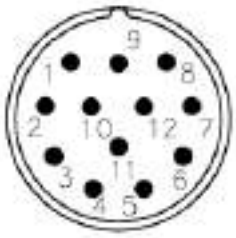
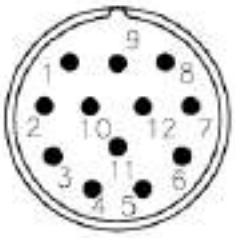
Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Az-**Az**-A-A-AAA		HDD09J-Pa-**Az**-Az-A-A-AAA					
							
Az	Straight top	Az	2 poles, 0.5 transf. ratio	SSz	Single turn	EMz	EQN 1325, 512 lines/rev
Bz	Angled top	Dz	2 poles, 0.3 transf. ratio	SMz	Multi turn	ENz	EQN 1325, 2048 lines/rev
Cz	Straight rear			SCz	Hollow shaft single turn	EQz	ECI 1118
Dz	Angled rear					ESz	ECN 1313, 512 lines/rev
Kz	Straight front					ETz	ECN 1313, 2048 lines/rev
Lz	Angled front					Without incremental signals:	
Xz	Special					EDz	EBI 135
						EEz	ECN 1325
						EFz	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Exc hi R1	1	–	1	Sensor (U_P)
2	Ground	2	Exc lo R2	2	–	2	–
3	Phase W	3	–	3	Gnd	3	–
4	Phase V	4	Cos hi S1	4	Cos	4	Sensor (0V)
A	Brake +24V	5	Cos lo S3	5	RefCos	5	Trip thermistor
B	Brake 0V	6	Sin lo S4	6	RefSin	6	Trip thermistor
C	–	7	Sin hi S2	7	Sin	7	U_P
D	–	8	–	8	+VCC	8	Clock
		9	–	9	+RS485	9	Clock’
		10	–	10	–RS485	10	0V (U_N)
		11	Trip thermistor	11	Trip thermistor	11	Shield
		12	Trip thermistor	12	Trip thermistor	12	B+ (if incr)
						13	B– (if incr)
						14	Data
						15	A+ (if incr)
						16	A– (if incr)
						17	Data’

t: HDD Standard pin–out with both trip and measurement thermistor (KTY) in power connector

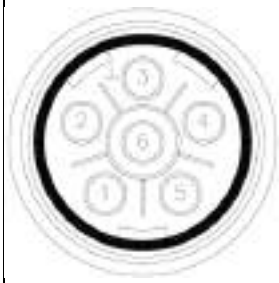
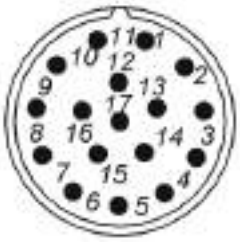
Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-At-**At**-A-A-AAA		HDD09J-Pa-**At**-At-A-A-AAA					
							
At	Straight top	At	2 poles, 0.5 transf. ratio	SSt	Single turn	EMt	EQN 1325, 512 lines/rev
Bt	Angled top	Dt	2 poles, 0.3 transf. ratio	SMt	Multi turn	ENt	EQN 1325, 2048 lines/rev
Ct	Straight rear			SCt	Hollow shaft single turn	EQt	ECI 1118
Dt	Angled rear					ESt	ECN 1313, 512 lines/rev
Kt	Straight front					ETt	ECN 1313, 2048 lines/rev
Lt	Angled front					Without incremental signals:	
Xt	Special					EDt	EBI 135
						EEt	ECN 1325
						EFt	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Exc hi R1	1	–	1	Sensor (U_P)
2	Ground	2	Exc lo R2	2	–	2	–
3	Phase W	3	–	3	Gnd	3	–
4	Phase V	4	Cos hi S1	4	Cos	4	Sensor (0V)
A	KTY +	5	Cos lo S3	5	RefCos	5	–
B	KTY –	6	Sin lo S4	6	RefSin	6	–
C	Trip thermistor	7	Sin hi S2	7	Sin	7	U_P
D	Trip thermistor	8	–	8	+VCC	8	Clock
		9	–	9	+RS485	9	Clock’
		10	–	10	–RS485	10	0V (U_N)
		11	–	11	–	11	Shield
		12	–	12	–	12	B+ (if incr)
						13	B– (if incr)
						14	Data
						15	A+ (if incr)
						16	A– (if incr)
						17	Data’

Note: The measurement thermistor is KTY–84 temperature measuring device.

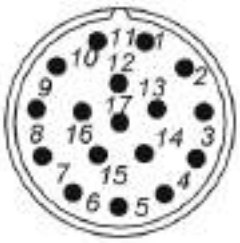
b: Infranor pin–out 1

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ab-**Eb**-A-A-AAA		HDD09J-Pa-**Ab**-Eb-A-A-AAA					
						May be available on request. Please contact HDD.	
Eb	Straight top	Ab	2 poles, 0.5 transf. ratio	SSb	Single turn		
Fb	Angled top	Db	2 poles, 0.3 transf. ratio	SMb	Multi turn		
Gb	Straight rear			SCb	Hollow shaft single turn		
Hb	Angled rear						
Mb	Straight front						
Nb	Angled front						
Pin		**Pin**		**Pin**			
1	Phase W	1	Sin– S4	1	VCC		
2	Phase U	2	Sin+ S2	2	Gnd		
3	Ground	3	Cos– S1	3	RefSin		
4	Phase V	4	Cos+ S3	4	RefCos		
5	Brake +24V	5	Trip thermistor	5	+RS485		
6	Brake 0V	6	Trip thermistor	6	–RS485		
		7	Ref– R2	7	Sin +		
		8	Ref+ R1	8	Cos +		
		9	–	9	Trip thermistor		
		10	–	10	Trip thermistor		
		11	–	11	–		
		12	–	12	–		

b: Infranor pin–out 2

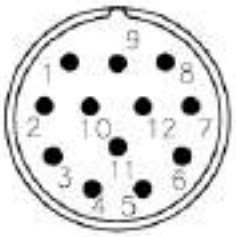
Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ab2-**Eb2**-A-A-AAA		HDD09J-Pa-**Ab2**-Eb2-A-A-AAA					
							
Eb2	Straight top	Ab2	2 poles, 0.5 transf. ratio	SSb2	Single turn	EMb2	EQN 1325, 512 lines/rev
Fb2	Angled top	Db2	2 poles, 0.3 transf. ratio	SMb2	Multi turn	ENb2	EQN 1325, 2048 lines/rev
Gb2	Straight rear			SCb2	Hollow shaft single turn	EQb2	ECI 1118
Hb2	Angled rear					ESb2	ECN 1313, 512 lines/rev
Mb2	Straight front					ETb2	ECN 1313, 2048 lines/rev
Nb2	Angled front					Without incremental signals:	
						EDb2	EBI 135
						EEb2	ECN 1325
						EFb2	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase W	1	Sin+ S2	1	Sin+	1	A+ (if incr)
2	Phase U	2	Sin– S4	2	Sin–	2	A– (if incr)
3	Ground	3	Cos+ S3	3	Cos+	3	B+ (if incr)
4	Phase V	4	Cos– S1	4	Cos–	4	B– (if incr)
5	Brake +24V	5	Ref+ R1	5	Data+	5	Clock
6	Brake 0V	6	Ref– R2	6	Data–	6	Clock’
		7	–	7	–	7	Data
		8	–	8	–	8	Data’
		9	–	9	–	9	–
		10	–	10	0V	10	0V
		11	–	11	+12V	11	+5V
		12	Trip thermistor	12	Trip thermistor	12	Trip thermistor
		13	Trip thermistor	13	Trip thermistor	13	Trip thermistor
		14	–	14	–	14	–
		15	–	15	–	15	–
		16	–	16	–	16	–
		17	–	17	–	17	–

c: Control Techniques pin–out

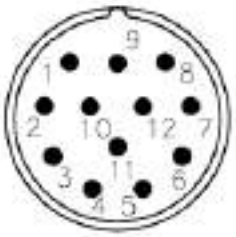
Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ac-**Ec**-A-A-AAA		HDD09J-Pa-**Ac**-Ec-A-A-AAA					
							
Ec	Straight top	Ac	2 poles, 0.5 transf. ratio	SSc	Single turn	EMc	EQN 1325, 512 lines/rev
Fc	Angled top	Dc	2 poles, 0.3 transf. ratio	SMc	Multi turn	ENc	EQN 1325, 2048 lines/rev
Gc	Straight rear			SCc	Hollow shaft single turn	EQc	ECI 1118
Hc	Angled rear					ESc	ECN 1313, 512 lines/rev
Mc	Straight front					ETc	ECN 1313, 2048 lines/rev
Nc	Angled front					Without incremental signals:	
						EDc	EBI 135
						EEc	ECN 1325
						EFc	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Exc hi	1	REF Cos	1	Trip thermistor
2	Phase V	2	Exc lo	2	+ Data	2	Trip thermistor
3	Ground	3	Cos hi	3	– Data	3	–
4	Phase W	4	Cos lo	4	+ Cos	4	–
5	Brake +24V	5	Sin hi	5	+ Sin	5	–
6	Brake 0V	6	Sin lo	6	REF Sin	6	–
		7	Trip thermistor	7	Trip thermistor	7	+ Clock
		8	Trip thermistor	8	Trip thermistor	8	– Clock
		9	–	9	Screen	9	+ Cos (if incr)
		10	–	10	0 V	10	+ Data
		11	–	11	–	11	– Data
		12	–	12	+Volts	12	– Cos (if incr)
						13	+ Sin (if incr)
						14	– Sin (if incr)
						15	+ 8V
						16	0 Volts
						17	Screen

Note: Location of connector key in resolver and hiperface connectors.

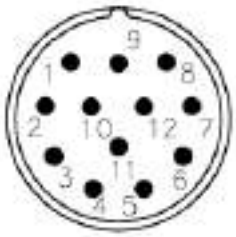
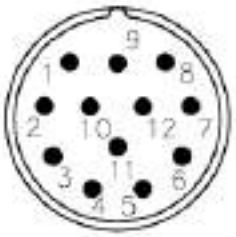
e: Elau pinout

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-SSe-**Ae**-A-A-AAA		HDD09J-Pa-**SSe**-Ae-A-A-AAA					
		May be available on request. Please contact HDD.				May be available on request. Please contact HDD.	
Ae	Straight top			SSe	Single turn		
Be	Angled top			SMe	Multi turn		
Ce	Straight rear			SCe	Hollow shaft single turn		
De	Angled rear						
Ke	Straight front						
Le	Angled front						
Pin				**Pin**			
1	Phase W			1	RefCos		
2	Ground			2	+ RS485		
3	Phase U			3	–		
4	Phase V			4	–		
A	Brake +24V			5	Sin		
B	Brake 0V			6	RefSin		
C	Trip thermistor			7	– RS485		
D	Trip thermistor			8	Cos		
				9	–		
				10	Gnd (0V)		
				11	–		
				12	+VCC (7–11V)		

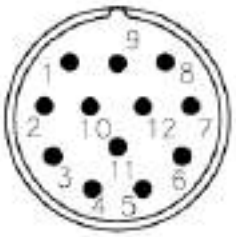
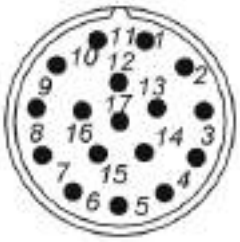
f: Ferrocontrol pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-SSf-**Af**-A-A-AAA		HDD09J-Pa-**SSf**-Af-A-A-AAA					
		May be available on request. Please contact HDD.				May be available on request. Please contact HDD.	
Af	Straight top			SSf	Single turn		
Bf	Angled top			SMf	Multi turn		
Cf	Straight rear			SCf	Hollow shaft single turn		
Df	Angled rear						
Kf	Straight front						
Lf	Angled front						
Pin				**Pin**			
1	Phase U			1	RefCos		
2	Ground			2	+ RS485		
3	Phase V			3	–		
4	Phase W			4	–		
A	Trip thermistor			5	Sin		
B	Trip thermistor			6	RefSin		
C	Brake +24V			7	– RS485		
D	Brake 0V			8	Cos		
				9	–		
				10	Gnd (0V)		
				11	–		
				12	+VCC (7–11V)		

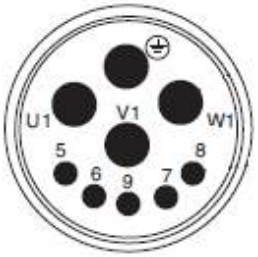
h: AMK pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ah-**Ah**-A-A-AAA		HDD09J-Pa-**Ah**-Ah-A-A-AAA					
						May be available on request. Please contact HDD.	
Ah	Straight top	Ah	2 poles, 0.5 transf. ratio	SSh	Single turn		
Bh	Angled top	Dh	2 poles, 0.3 transf. ratio	SMh	Multi turn		
Ch	Straight rear			SCh	Hollow shaft single turn		
Dh	Angled rear						
Kh	Straight front						
Lh	Angled front						
Pin		**Pin**		**Pin**			
1	Phase U	1	Sin +	1	Sin +		
2	Ground	2	Sin –	2	RefSin		
3	Phase V	3	Cos +	3	Cos +		
4	Phase W	4	Cos –	4	RefCos		
A	Trip thermistor	5	–	5	–		
B	Trip thermistor	6	–	6	Gnd		
C	Brake +24V	7	–	7	–		
D	Brake 0V	8	Screen	8	Screen		
		9	Exc +	9	+RS485		
		10	Exc –	10	–RS485		
		11	–	11	Us (7–12V)		
		12	–	12	–		

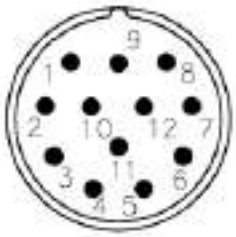
i: Bosch-Rexroth-Indramat pin–out 1

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-SSi-**Ai**-A-A-AAA		HDD09J-Pa-**SSi**-Ai-A-A-AAA					
		May be available on request. Please contact HDD.					
Ai	Straight top			SSi	Single turn	EMi	EQN 1325, 512 lines/rev
Bi	Angled top			SMi	Multi turn	ENi	EQN 1325, 2048 lines/rev
Ci	Straight rear			SCi	Hollow shaft single turn	EQi	ECI 1118
Di	Angled rear					ESi	ECN 1313, 512 lines/rev
Ki	Straight front					ETi	ECN 1313, 2048 lines/rev
Li	Angled front					Without incremental signals:	
						EDi	EBI 135
						EEi	ECN 1325
						EFi	ECN 1337
						Additional Endat types…	
Pin				**Pin**		**Pin**	
1	Phase U			1	+VCC (7–11V)	1	A+ (if incr)
2	Ground			2	Gnd (0V)	2	A– (if incr)
3	Phase W			3	Ref Sin	3	Data+
4	Phase V			4	Ref Cos	4	–
A	Brake +24V			5	Data +	5	Clock+
B	Brake 0V			6	Data –	6	–
C	Trip thermistor			7	Sin +	7	0V
D	Trip thermistor			8	Cos +	8	KTY+
				9	–	9	KTY–
				10	–	10	+5V
				11	–	11	B+ (if incr)
				12	–	12	B– (if incr)
						13	Data–
						14	Clock–
						15	0V sense
						16	+5V sense
						17	Shield

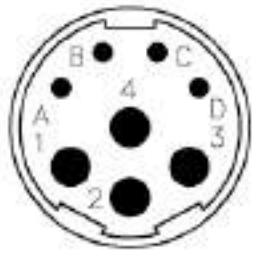
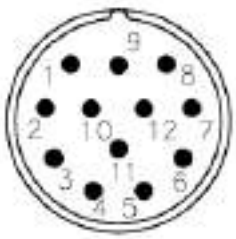
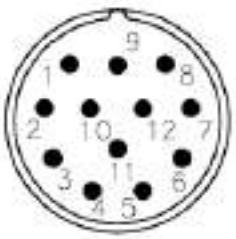
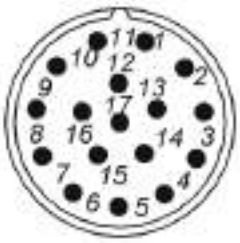
i2: Bosch-Rexroth-Indramat pin–out 2

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-SSi2-**Pi2**-A-A-AAA		HDD09J-Pa-**SSi2**-Pi2-A-A-AAA					
		May be available on request. Please contact HDD.					
Pi2	Straight top			SSi2	Single turn	EMi2	EQN 1325, 512 lines/rev
Qi2	Angled top			SMi2	Multi turn	ENi2	EQN 1325, 2048 lines/rev
Si2	Straight rear			SCi2	Hollow shaft single turn	EQi2	ECI 1118
Ti2	Angled rear					ESi2	ECN 1313, 512 lines/rev
Ui2	Straight front					ETi2	ECN 1313, 2048 lines/rev
Vi2	Angled front					Without incremental signals:	
						EDi2	EBI 135
						EEi2	ECN 1325
						EFi2	ECN 1337
						Additional Endat types…	
Pin				**Pin**		**Pin**	
1	Phase U			1	+VCC Encoder	1	+VCC Encoder
2	Ground			2	GND	2	GND
3	Phase W			3	A+ (if incr)	3	A+ (if incr)
4	Phase V			4	A– (if incr)	4	A– (if incr)
5	KTY84 +			5	B+ (if incr)	5	B+ (if incr)
6	KTY84 –			6	B– (if incr)	6	B– (if incr)
7	Brake +24V			7	Data+	7	Data+
8	Brake 0V			8	Data–	8	Data–
9	–			9	–	9	Clock+
				10	–	10	Clock–

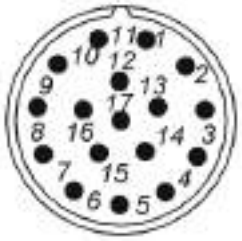
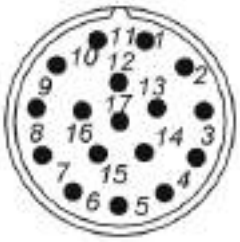
k: Kollmorgen–Seidel pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ak-**Ak**-A-A-AAA		HDD09J-Pa-**Ak**-Ak-A-A-AAA					
						May be available on request. Please contact HDD.	
Ak	Straight top	Ak	2 poles, 0.5 transf. ratio	SSk	Single turn		
Bk	Angled top	Dk	2 poles, 0.3 transf. ratio	SMk	Multi turn		
Ck	Straight rear			SCk	Hollow shaft single turn		
Dk	Angled rear						
Kk	Straight front						
Lk	Angled front						
Pin		**Pin**		**Pin**			
1	Phase U	1	–	1	RefSin		
2	Ground	2	Trip thermistor	2	Gnd		
3	Phase W	3	Sin S3	3	RefCos		
4	Phase V	4	Cos S4	4	Up +8V		
A	Brake +24V	5	Exc R2	5	+RS485		
B	Brake 0V	6	Trip thermistor	6	–		
C	–	7	Sin S1	7	Trip thermistor		
D	–	8	Cos S2	8	–		
		9	Exc R1	9	Sin		
		10	–	10	–		
		11	–	11	Cos		
		12	–	12	–		
				13	–Rs485		
				14	Trip thermistor		
				15	–		
				16	–		
				17	–		

o: KEB pin–out

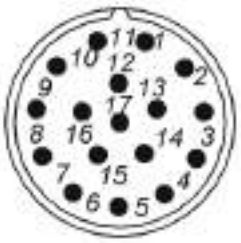
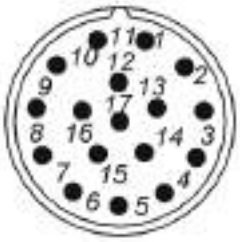
Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Ao-**Ao**-A-A-AAA		HDD09J-Pa-**Ao**-Ao-A-A-AAA					
							
Ao	Straight top	Ao	2 poles, 0.5 transf. ratio	SSo	Single turn	EMo	EQN 1325, 512 lines/rev
Bo	Angled top	Do	2 poles, 0.3 transf. ratio	SMo	Multi turn	ENo	EQN 1325, 2048 lines/rev
Co	Straight rear			SCo	Hollow shaft single turn	EQo	ECI 1118
Do	Angled rear					ESo	ECN 1313, 512 lines/rev
Ko	Straight front					ETo	ECN 1313, 2048 lines/rev
Lo	Angled front					Without incremental signals:	
						EDo	EBI 135
						EEo	ECN 1325
						EFo	ECN 1337
						Additional Endat types…	
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	SIN–	1	–	1	Sensor (U_P)
2	Ground	2	COS+	2	–	2	–
3	Phase W	3	–	3	–	3	–
4	Phase V	4	–	4	REF_SIN–	4	Sensor (0V)
A	Brake +24V	5	REF+	5	REF_COS–	5	–
B	Brake 0V	6	–	6	Data+	6	–
C	Temp+	7	REF–	7	Data–	7	+5V
D	Temp–	8	–	8	SIN+	8	Clock+
		9	–	9	COS+	9	Clock–
		10	SIN+	10	+ 7.5V	10	COM
		11	COS–	11	COM	11	Shield
		12	–	12	–	12	B+ (if incr)
						13	B– (if incr)
						14	Data+
						15	A+ (if incr)
						16	A– (if incr)
						17	Data–

p: Parker pin–out

Power		**Resolver**		**Endat without incremental signals**		**Endat**	
HDD09J-Pa-Ap-**Ap**-A-A-AAA		HDD09J-Pa-**Ap**-Ap-A-A-AAA					
							
Ep	Straight top	Ap	2 poles, 0.5 transf. ratio	EDp	EBI 135	EMp	EQN 1325, 512 lines/rev
Fp	Angled top	Dp	2 poles, 0.3 transf. ratio	EEp	ECN 1325	ENp	EQN 1325, 2048 lines/rev
Gp	Straight rear			EFp	ECN 1337	EQp	ECI 1118
Hp	Angled rear			EHp	ECI 119	ESp	ECN 1313, 512 lines/rev
Mp	Straight front			EPp	EBI 1135	ETp	ECN 1313, 2048 lines/rev
Np	Angled front			EVp	ECI 1319		
				EWp	EQI 1321		
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Sin hi S2	1	–	1	A+ (if incr)
2	Phase V	2	Sin lo S4	2	–	2	A– (if incr)
3	Shield	3	–	3	D+	3	D+
4	Brake +24V	4	–	4	–	4	–
5	Brake 0V	5	–	5	C+	5	C+
6	Phase W	6	–	6	–	6	–
		7	Exc lo R2	7	0V	7	0V
		8	Trip thermistor	8	KTY+	8	Trip thermistor
		9	Trip thermistor	9	KTY –	9	Trip thermistor
		10	Exc hi R1	10	+5V	10	+5V
		11	Cos hi S1	11	–	11	B+ (if incr)
		12	Cos lo S3	12	–	12	B– (if incr)
				13	D–	13	D–
				14	C–	14	C–
				15	0V sense	15	0V sense
				16	+5V sense	16	+5V sense
				17	shield	17	shield

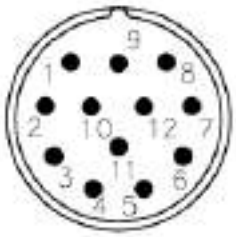
Note: Location of connector key in resolver connectors.

s: Siemens pin–out

Power		**Resolver**		**Endat without incremental signals**		**Endat**	
HDD09J-Pa-As-**As**-A-A-AAA		HDD09J-Pa-**As**-As-A-A-AAA					
							
Es	Straight top	As	2 poles, 0.5 transf. ratio	EDs	EBI 135	EMs	EQN 1325, 512 lines/rev
Fs	Angled top	Ds	2 poles, 0.3 transf. ratio	EEs	ECN 1325	ENs	EQN 1325, 2048 lines/rev
Gs	Straight rear			EFs	ECN 1337	EQs	ECI 1118
Hs	Angled rear			EHs	ECI 119	ESs	ECN 1313, 512 lines/rev
Ms	Straight front			EPs	EBI 1135	ETs	ECN 1313, 2048 lines/rev
Ns	Angled front			EVs	ECI 1319		
				EWs	EQI 1321		
				EYs	ECI 1118		
Pin		**Pin**		**Pin**		**Pin**	
1	Phase U	1	Sin hi S2	1	–	1	A+ (if incr)
2	Phase V	2	Sin lo S4	2	–	2	A– (if incr)
3	Shield	3	–	3	D+	3	D+
4	Brake +24V	4	–	4	–	4	–
5	Brake 0V	5	–	5	C+	5	C+
6	Phase W	6	–	6	–	6	–
		7	Exc lo R2	7	0V	7	0V
		8	KTY+	8	KTY+	8	KTY+
		9	KTY –	9	KTY –	9	KTY –
		10	Exc hi R1	10	+5V	10	+5V
		11	Cos hi S1	11	–	11	B+ (if incr)
		12	Cos lo S3	12	–	12	B– (if incr)
				13	D–	13	D–
				14	C–	14	C–
				15	0V sense	15	0V sense
				16	+5V sense	16	+5V sense
				17	shield	17	shield

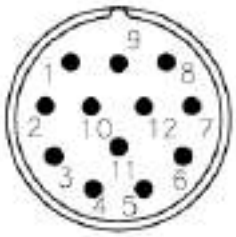
Note: The thermistor is a Siemens–compatible KTY–84 temperature measuring device. For motors with the same pinout but with standard PTC protection thermistor, please refer to the "p" pinout.
Note: Location of connector key in resolver connectors.

u: Baumüller pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Au-**Au**-A-A-AAA		HDD09J-Pa-**Au**-Au-A-A-AAA					
				May be available on request. Please contact HDD.		May be available on request. Please contact HDD.	
Au	Straight top	Au	2 poles, 0.5 transf. ratio				
Bu	Angled top	Du	2 poles, 0.3 transf. ratio				
Cu	Straight rear						
Du	Angled rear						
Ku	Straight front						
Lu	Angled front						
Pin		**Pin**					
1	Phase V	1	Cos+ S3				
2	Ground	2	–				
3	Phase U	3	–				
4	Phase W	4	–				
A	Brake +24V	5	Sin– S4				
B	Brake 0V	6	Sin+ S2				
C	–	7	KTY+				
D	–	8	Cos– S1				
		9	KTY –				
		10	Ref– R2				
		11	–				
		12	Ref+ R1				

Note: The thermistor is KTY–84 temperature measuring device

n: Baldor pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-An-**An**-A-A-AAA		HDD09J-Pa-**An**-An-A-A-AAA					
				May be available on request. Please contact HDD.		May be available on request. Please contact HDD.	
An	Straight top	An	2 poles, 0.5 transf. ratio				
Bn	Angled top	Dn	2 poles, 0.3 transf. ratio				
Cn	Straight rear						
Dn	Angled rear						
Kn	Straight front						
Ln	Angled front						
Pin		**Pin**					
1	Phase U	1	Exc+ R1				
2	Ground	2	Exc– R2				
3	Phase W	3	Cos+ S1				
4	Phase V	4	Cos– S3				
A	Trip thermistor	5	Sin+ S2				
B	Trip thermistor	6	Sin– S4				
C	Brake +24V	7	–				
D	Brake 0V	8	–				
		9	–				
		10	–				
		11	–				
		12	–				

v: YTec pin–out

Power		**Resolver**		**Hiperface**		**Endat**	
HDD09J-Pa-Av-**Y2v**-A-A-AAA		HDD09J-Pa-**Av**-Y2v-A-A-AAA					
				May be available on request. Please contact HDD.		May be available on request. Please contact HDD.	
Y1	Angled top mount	Av	2 poles, 0.5 transf. ratio				
		Dv	2 poles, 0.3 transf. ratio				
Pin		**Pin**					
A	Phase U	1	–				
B	Phase W	2	KTY84-130+				
C	Phase V	3	S4 Cos–				
gnd	Ground	4	S3 Sin–				
1	Brake +24V	5	R2 Exc–				
2	Brake 0V	6	KTY84-130–				
3	–	7	S2 Cos+				
4	–	8	S1 Sin+				
5	–	9	R1 Exc+				
		10	–				
		11	–				
		12	–				